ELECTRICAL REVIEW

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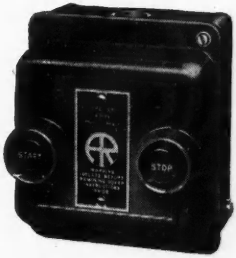

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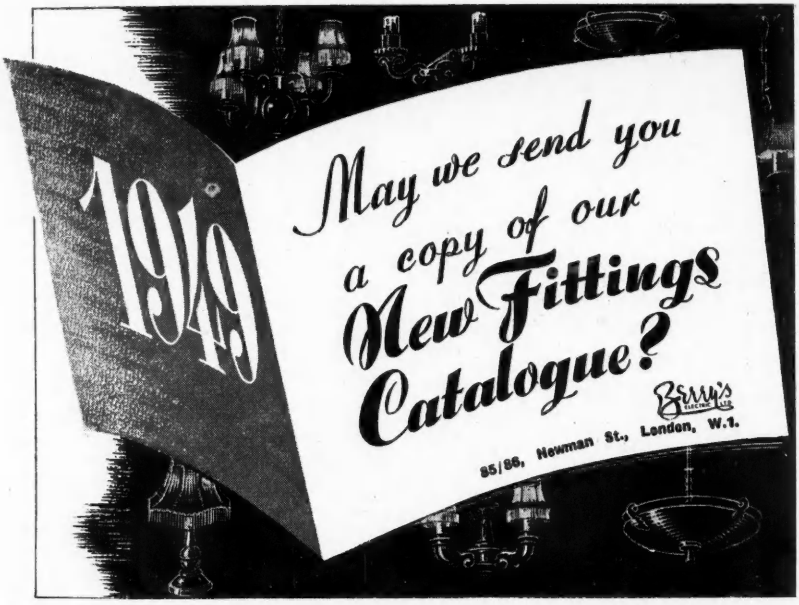

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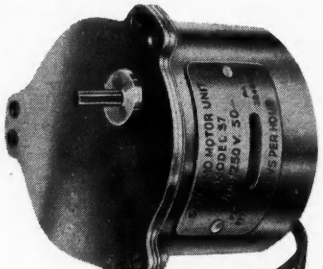

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Fuels for Boilers

INFLUENCE ON AVAILABILITY

NOWADAYS one frequently hears generation and fuel-efficiency engineers complain of having to steam boilers at something below their original rated outputs because of the impossibility of firing the plant with the type of fuel for which they were initially designed. The degree of "under running" varies very considerably and in each case irregularly. We would not speculate on a figure, neither would we attempt to measure the production increase which could be brought about by the provision of the "correct" grades of fuel. We feel, however, on safe ground in saying that the possible increase must be considerable and that an effort to provide the appropriate fuels in the proper places at the right times would be a sound national investment.

Indifferent Fuel

A very strong case can be established for the allocation of specially selected fuel to highly rated boilers. Because of the variable quality of the ash content of indifferent fuel and the limitations imposed by its presence in increasing quantity, boilers have had to be moderately rated in order to maintain satisfactory availability.

This has been the real reason for the sudden increased use of powdered coal, which is expected to reach 35 per cent of the total in a year's time, representing a rise from less than one million to ten million tons annually in twenty years. Boilers fired with pulverized fuel have a proved reliability at least as great as that of the best stoker-fired equivalents and, moreover, when suitably designed, may be kept commercially clean by the use of soot blowers only between annual overhauls.

The onerous circumstances of war emphasized the availability factor. Subsequent realization of its vital influence has largely governed progressive development towards better thermal efficiency, previously attainable only under test conditions.

Adjustments in Firing Methods

Electricity generation, affecting as it does nearly all other industries, deserves first attention; but power stations have not suffered alone. There is no doubt that deterioration of the general supply of coal to industry has also necessitated adjustments of methods of firing boilers to maintain steam output. It will suffice to recall two examples.

First, in some power stations heavy fuel-oil has been employed to upgrade the slack coal burned on chain-grate stokers, but this experiment is dependent upon the availability of oil. Secondly, at various works within the Courtauld textile organization positive ignition control has been secured by injecting steam at high velocity over the front portion of the fuel bed. This system has enabled full output to be obtained with the same low-grade fuels which would otherwise have caused some 35 per cent down-rating of the plant.

The latest and least expected development has been initiated by Imperial

Chemical Industries, which has lately been granted by the Petroleum Board a prospector's licence covering 169 square miles in the Whitby district. Apart from constantly seeking for fresh sources of chemical substances, the I.C.I. object in this instance is reported to be a search for natural gas suitable for use as a fuel. If found in adequate quantity, it "would obviously be useful" to the Billingham plant (the largest steam-electric private installation of its kind in the United Kingdom) as well as to the nearby new plastics factory at Wilton with its petroleum cracking plant now being built.

It was in this same North Yorkshire locality that the D'Arcy Exploration Co., a subsidiary of the Anglo-Iranian Oil Co., discovered methane gas just before the war. Gas-fired boilers are not novel, but the gases burned are usually manufactured or by products of other industries, not "natural" in the American sense of that term.

CONSULTANTS AND CONTRACTORS

We doubt whether the Electricity Boards would adopt the practices suggested in a letter from "Engineer" in our 7th January issue when acting in the dual role of consultants and contractors. There is little doubt, however, of the undesirability of the Boards' left hands knowing too much of what their right hands are doing in this respect. It is very useful, of course, for a Board to quote to a specification which it has prepared itself but it is questionable whether this is the fair competition with "private" contractors which we have understood will be a guiding principle in the electrical contracting activities of the Electricity Boards.

ABSOLUTE UNITS

It is just a year since the system of electrical units was changed from the international to the absolute, originally due in 1940 and postponed because of the war. Reactions to reforms of this kind usually become evident, but in this case the change has been made too easily. It does not seem to have mattered, which is disturbing to Sir Charles Darwin, who directs the affairs of the National Physical Laboratory. Speaking as the principal guest at the I.E.E. Measurements Section dinner last week, he observed that only the N.P.L. and the National Bureau of Standards, Washington, had done anything of ultimate worth towards arrival at the final (ohm, volt, ampere) values. The Americans have perhaps done a little better than the British, but it is comforting to know that each fresh calibration in the U.S.A. has come nearer to the determinations made in the U.K. Present values are good enough for industry anyway. According to Sir Charles it will need an inspiration on the part of someone to produce anything better.

VEHICLE LIGHTING

Lack of room for mounting fittings has always restricted designers of internal equipment for road and railway coaches. The space factor is more severe upon fluorescent than filament lighting because the tube is larger than the bulb. In spite of awkward technicalities and physical limitation, the degree of success achieved may be judged from the fact that for each watt of primary power nearly twice the lumens are now obtainable from fluorescent lamps as from tungsten filament lamps. As Messrs. Ruff, Hull & Mills pointed out in their paper before the Illuminating Engineering Society this week, d.c./a.c. conversion by motor-alternator offers the opportunity of choosing the voltage and frequency most suitable for fluorescent lamps in traction service.

RUBBER SITUATION

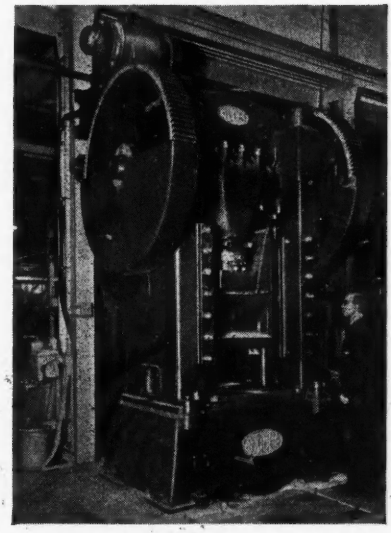
Recovery of the rubber growing industry since the war ended has been much more rapid than was expected, with the result that production is well in advance of present demand. In the first eleven months of 1948 the production, according to the Secretariat of the Rubber Study Group, was 1,382,500 long tons and consumption 1,277,500 tons. Stocks at the end of the period (excluding Government stocks not available to industry) stood at 760,000 tons—equivalent to over six months' supply at the present rate of consumption. Synthetic rubber production also exceeded its use (487,500 tons against 447,500 tons) and stocks rose by 40,000 tons to 117,500 tons.

Making Safes

APPLICATIONS IN A COMPLETELY NEW FACTORY

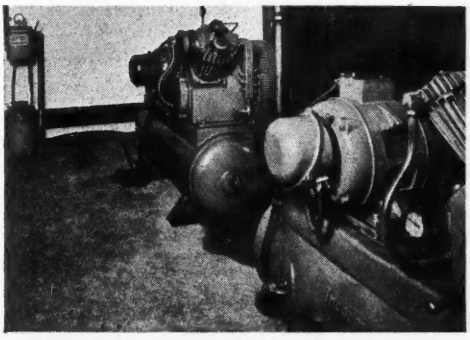
FIRST under the name of Thomas Milner & Son and later Milners' Safe Co., Ltd., the manufacture of fire-resisting safes was carried out in a factory in Liverpool. This factory was severely damaged by enemy action during the war but a new works had been erected at Speke in consequence of the growth of the company's work. The new factory covers an area of about ten acres and this article describes briefly the modern electrical installation and applications in an example of very highly mechanized production. All the electrical equipment was supplied by the General Electric Co., Ltd., and the installation was carried out by Campbell & Isherwood, Ltd.

Practically the whole of the products are made entirely of steel of various grades, and many of these steels are required to possess very special qualities in order to make them suitable for use in the construction of safes. For the high-protection grade safes a special alloy armouring has been developed, and for all practical purposes this steel is proof against drills, explosives and blowpipes, and will defeat the most expert cracksman. Where the degree of protection does not justify the use of the alloy armouring a specially prepared drill-resisting armour plate is used. The light-gauge "sheets" are received at the works rolled and surfaced ready for use, but the heavy-gauge "plates" are first straightened by passing them through 6ft rolls. Then the plates or sheets are cut to size in standard 5ft and 10ft shearing machines. The smaller machines are belt driven from a lineshaft in groups of five, but the larger ones are driven individually. In each case, however, the motors are 20 h.p. slipring machines. After the edges of the plates have been planed and ground, any necessary drilling is performed on radial drills driven by 8 h.p. squirrel cage motors. Ten-foot multi-punching machines driven by 20 h.p. slipring motors are used for punching the lighter sheets. Special shapes are cut by means of oxy-gas cutters, controlled by a template to such great accuracy that comparatively little machining is necessary.



A 45½-ton Rhodes press driven by a 25-h.p. slipring motor is used for forming components

The sheets and plates are next formed and bent to the required



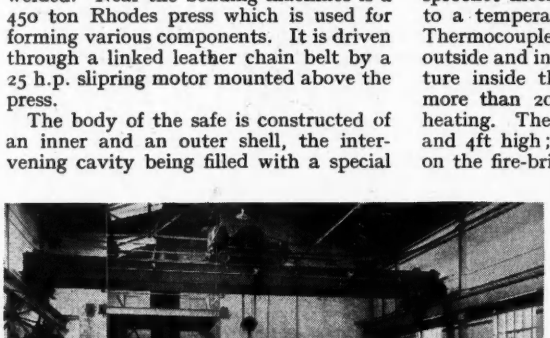
Air for spraying is provided at 50 lb per sq in by two 1½-h.p. motor-driven compressors

shapes on 10ft and 12ft bending machines. The machines which deal with the sheets are driven by 20 h.p. slipring motors, but those used for bending the heavier plates are hydraulically operated under high pressure. All the joints are electrically welded. Near the bending machines is a 450 ton Rhodes press which is used for forming various components. It is driven through a linked leather chain belt by a 25 h.p. slipring motor mounted above the press.

The body of the safe is constructed of an inner and an outer shell, the intervening cavity being filled with a special fire- and heat-resisting composition which has been developed by Milners over a long period. The construction of the doors for safes and strong rooms is in many respects similar to that of the safe bodies. The rolled sections of the frame are welded together and the door sheets are machined to fit the frame. There is, however, an additional section in the doors which houses the boltwork, covering which is the fire-resisting chamber inside the door. The door is mounted on double pivots, one half being dowelled and welded to the door and the other to the frame of the safe body.

One of the most interesting departments is that devoted to the design and manufacture of the bolting and locking mechanisms for safes. The assembly section is essentially a hand-operated department involving intricacies of a very special character.

An outstanding piece of apparatus, said to be the most modern of its kind in this country, is the electric testing furnace in which the heat resisting qualities of safes are tried. The safe to be tested is taken into the oven by means of a wheeled trolley running on rails. The oven door having been closed by a chain and sprocket mechanism, the oven is heated to a temperature of about 300 deg. F. Thermocouples measure the temperatures outside and inside the safe. The temperature inside the safe should not rise to more than 200 deg F after four hours' heating. The oven is 4ft wide, 5ft deep and 4ft high; the elements are mounted on the fire-brick lining in such a manner that intense heat is directed on the safe at all points. The loading of the oven is 100 kW at 440 V, three-phase.



In a well-equipped brass foundry is a two-ton cupola furnace; note overhead crane

A very important part of the factory output consists of light steel products such as office equipment, filing cabinets, lockers and shelving, as well as steel desks, chairs and other furniture. Throughout the large section of the works where these are produced methods of manufacture similar to those already described are employed, and the same use is made of electrically driven machinery as in the construction of safes. Many of the products are made in "knock down" form, e.g., detachable table legs, to facilitate packing for the company's large export trade.

Welding is employed almost exclusively, considerable discrimination being displayed in the choice of welding systems for different purposes, arc, spot and gas welding each having its particular duty. Spot welding, not employed in the manufacture of safes, is used extensively in the light steel products for such purposes as the fixing of stiffeners and other components to doors, furniture and the like.

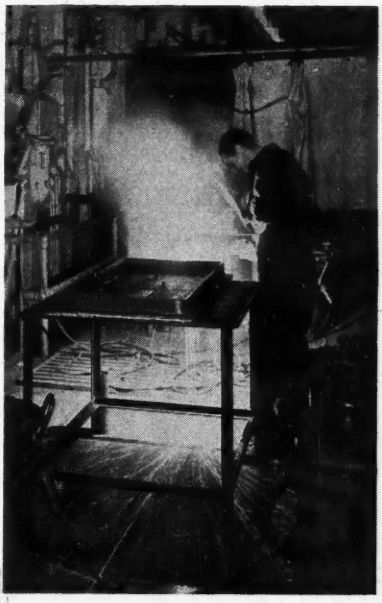
The steel shutters produced by the company consist of interlocking rolled slats forming a series of hinges. The slats

are formed up to 20ft in length, in widths of 2in, 2½in and 3in. Forming is done in up to about ten stages on one rolling mill driven by a 10 h.p. squirrel cage motor. The smallest sizes of shutters are designed for direct manual operation and are self-coiling, while the larger sizes are man operated by chain or winch or are electrically driven.

The motor of the last mentioned is of 1 or 1.5 h.p. according to the size of the shutter, and is of the geared type with a speed reduction to 80 r.p.m., the worm drive operating through a clutch. The clutch is opened when it is necessary to operate the shutter by hand. Control is by a direct-to-line reversing contactor starter and a top limit switch is associated with this. For safety the push-button switch must be held in throughout the time the shutter is being lowered.

Almost all fittings such as safe-door handles, brass furniture, and so on, which are used in the company's products are made in a well-equipped brass foundry in which is a cupola furnace having a capacity of 2 tons per hour. Small iron parts are also cast here. In conjunction with the foundry is an equally complete plating department where high-grade chromium and other plating is carried out by up-to-date methods.

Close attention is given to the finish of all the products and a very complete spraying and finishing department has been established. Air for spraying is provided at 50lb per sq in by two Ingersoll-Rand compressors driven by 10 h.p. slipring motors. Safes are first sprayed with red oxide and are then primed, filled and rubbed down, and after further protective coats have been applied are sprayed with cellulose enamel. Components of the light steel products are degreased, dipped in enamel and baked at 300 deg F; after assembly they are



A feature of the welding bay is a twelve-operator equipment which embodies a 300 kVA transformer with a condenser unit attached

An adequate and even standard of illumination is provided by high-pressure mercury-vapour lamps

sprayed with air-drying cellulose to give them the matt finish which the company employs as a standard.

In the welding bay the principal equipment is a twelve-operator equipment incorporating a 360 kVA, three-phase, 400/100 V transformer, with a condenser unit attached, and twelve portable oil-filled current regulating reactors. A number of single-operator portable welding sets are also in use throughout the works.

There is a well-equipped tool shop, and a furnace used for tool hardening is rated at 37.5 kVA and operates at 10 to 20 V, with a safe working temperature of approximately 1,350 deg C.

High pressure mercury vapour lamps are used throughout the factory and provide an adequate and even standard of illumination.

The incoming supply from the public system is at 11 kV and is received at a four-cubicle switchboard in the main substation, serving two 500 kVA, 11 kV/400 V transformers and the testing oven. The transformers feed a 24-unit switchboard with oil-immersed industrial-type circuit breakers controlling factory feeders.

The main distribution board has 24 industrial-type circuit breakers

I.E.E. Section Dinner

SEASONABLE fare was served at the annual dinner last week at the Café Royal of the I.E.E. Measurements Section. The toast of "Our Guests" was proposed by Dr. S. Whitehead (Electrical Research Association), the Section chairman, and acknowledged by Mr. T. G. N. Haldane (President), who called upon the principal guest to speak.

In his response Sir Charles Darwin (National Physical Laboratory) remarked upon the great awareness in educational circles that all was not as it should be. They were too self-critical. The explanation was simple; they were attempting to do in three-year university courses what most other countries found it impossible to do in less than five years. The universities were trying to make engineering scientists, whereas they needed to train men to know their science from the bottom upward, yet remain primarily practical engineers. Only by doing that would they be able to compete with the rest of the world. Prof. Willis Jackson hoped to be able to do something like that at the City and Guilds College and he would be fully backed in his endeavour. The motto *Disce Doce* ("Learn and Teach") was an admirable one for the I.E.E., and Sir Charles hoped its members would live up to that rather difficult ideal.

Prof. J. Greig (vice-chairman) proposed the toast of "The Chairman," and the following entertainment, music and songs, included an exhibition of conjuring by an apostle of standardization whose dexterity was checked by the miscalculation of a fixing centre due to the overall dimensions being non-standard.

Nationalization in Madras

The Madras Government has decided to nationalize electricity undertakings in the Province and draft legislation is being submitted to the Central Government of India for approval. The acquisition of the undertaking of the Madras Electric Supply Corporation by the Government has already been announced.

Motor Site Conditions

What Manufacturers Want to Know

By K. W. JEROME,
Graduate I.E.E.

SITE conditions for electric motor installations frequently receive too little attention from prospective users. In some cases, apart from stating the type of motor enclosure required, e.g., whether screen-protected, drip-proof, totally enclosed—they are completely ignored.

At the present time, customers should try to use a standard motor wherever possible to ensure earliest delivery, as any development work because of variations from the standard is bound to cause delay. The information required by motor manufacturers may be divided into that on general, mechanical and electrical conditions.

Under general conditions is included the atmospheric temperature in which the motor will have to operate, in order that its temperature rise may be calculated and its frame size thereby determined. Types of enclosure depend primarily on prevailing conditions, i.e., the presence or absence of dust, damp or an explosive atmosphere, or exposure to weather. Special impregnation of the winding and insulation is required if the motor will be affected by chemical fumes, acids or alkalis. Although the modern motor is reasonably quiet in operation, special designs are sometimes required for installation in hospitals, offices and sleeping quarters for operating lifts, refrigerators or air-conditioning plant.

Mechanical Requirements

The nature of the load will affect the motor rating and frame size, as it may be continuous, intermittent, fluctuating, or requiring speed variation throughout its duty cycle. If the motor is only half-hour or one-hour rated the frame size will be much smaller than that for continuous operation. Heavy shock loads (as in mill drives) will necessitate special construction. The direction of the drive must not be forgotten. Vertical motors are normally designed with a thrust bearing to carry the weight of the rotor only, and any additional thrust loading should be specified. Motors for ceiling mounting usually need a special frame in all but the smallest sizes.

The manufacturer should be informed if he is to supply the bedplate or slide-rails or whether the motor is to be mounted on an existing bedplate, and whether he should provide a half-coupling, pulley, holding-down screws or foundation bolts. Available motor space, height of centre line of driven machine, and position of a trifurcating box (if supplied) should be mentioned. With belt or rope drives the pulley dimensions should be stated, also the number of ropes in the case of a grooved pulley, to determine bearing size. The pulley width will determine the overall length of the set.

Provision of a double shaft extension, i.e., projection of the shaft at each end of the motor, is simple on a squirrel-cage motor, but for a slip-ring machine it necessitates placing the brush gear between the bearings. Examples are lift motors with squared shaft extension at the non-driving end for hand operation in the event of power failure, synchronous motors connected to the load at one end and the exciter at the other and motors with pumps connected at each end. For direct-coupled compressor drives, provision must be made for end-play.

Electrical Data

Several electrical conditions affect both squirrel-cage and slip-ring motors. Various British Standard Specifications apply to a.c. motors, the most commonly used being B.S. No. 168/1936, No. 226/1925, No. 170/1926, No. 169/1925 and No. 270/1930. The temperature rise should be stated as this determines the class of insulation to be employed. The height of the motor above sea level will also affect its rating.

In countries having a humid atmosphere, heaters may have to be installed to keep the motors free from condensation, as also in sugar factories where the

motors may be inoperative for long periods.

If there is a long cable run to the motor this should be indicated, as voltage drop in the cable will decrease the torque available. The required overload capacity should be specified. A load with a high inertia involving a lengthy running-up period or a load with high static friction ("stiction") may require a larger frame than normal to dissipate the increased heat. The number of starts per hour and of reversals will also influence the motor size.

Any limits imposed by supply authorities on the starting current of squirrel-cage motors should be ascertained and passed on to the motor manufacturers. The method of starting should also be specified, namely, star-delta, direct-on or auto-transformer, as this determines the torque available at starting.

A double-cage motor is suitable for a high starting torque up to about 2¼ times full-load torque where low starting current is needed and where the load can be accelerated rapidly.

For slip-ring motors, torque is available up to about 2¼ times full-load value and the heat generated is dissipated in the external motor resistance. If brush wear and losses are of any moment, brush-raising and short-circuiting gear should be specified, but this is, of course, only necessary for machines that run continuously.

Such particulars as the above, if stated clearly and concisely to motor manufacturers, will save them and customers much time and trouble and will expedite delivery. This applies especially to motors for export, for which speed of delivery and motor suitability are vital selling points.

Dental X-Ray Unit

SPECIALLY DEVELOPED TUBE 2¼ IN. LONG

AN unusual X-ray unit designed for the dental surgery is the "Oralix" (Philips Electrical, Ltd., Century House, Shaftesbury Avenue, London, W.C.2). For this equipment a special X-ray tube has been developed which is believed to be the smallest ever made for a practical application.

Philips "Oralix" dental X-ray unit and (inset) its associated tube

The tube measures only 2¼in. in length and is encased, together with an oil-immersed transformer, in a container approximately 5in. long and 4in. in diameter. X-rays emerge through the orthodox side window, and a neon lamp in the side of the director cone indicates when exposure is taking place.

Exposure of the negative is effected by placing the film, wrapped in light-proof packing, into the mouth of the patient, behind the teeth. The direction of the X-ray beam is then adjusted to radiograph the particular view required, and the exposure made. The exposure time is controlled by means of a clockwork time switch, which is calibrated in tenths of a second up to six seconds and held in the operator's hand. When the predetermined time has elapsed, radiation is automatically cut off by this arrangement.

An interesting feature of this unit is that the cylindrical casing is fitted with a handle containing an oil expansion chamber to take the increased volume of oil as it heats up. Four models are available which, while being basically the same, are furnished with different fixing and mounting arrangements to suit a variety of requirements.

Views on the News

By REFLECTOR

THIS year's Faraday Lecture of the Institution of Electrical Engineers should be of more general interest than for some years past. The subject is "Television," and the authors are Sir Noel Ashbridge and Mr. H. Bishop. Apart from the wide appeal of the subject, the fact that the latest equipment used by the B.B.C. for its outside television broadcasts will televise direct from the platform to receiving sets standing amongst the audience should ensure that the Central Hall, Westminster, will be well filled on 16th February. Other important events, I see, are the annual dinner to be held at the Connaught Rooms on 24th February, the Kelvin Lecture (21st April) on "Semi-Conductors and Rectifiers," to be given by Prof. N. F. Mott, the annual general meeting on 12th May, and the summer meeting, which will be held in Scotland from 30th May to 3rd June.

★ ★ ★

Four ladies have been appointed members of the London Electricity Consultative Council and three of them appear to have been interrogated as to their "electricity-mindedness" by the daily Press. Alderman Mrs. Gregory, of course, is well known to electrical people for her ardent advocacy of electricity for everything. Councillor Mrs. Coyle claims to be one of the first women in Bermondsey to install an electric cooker. But Mrs. Carroll-Marks, who is in charge ot the W.V.S. fuel economy campaign, cooks by gas and heats by electricity. I hope for her early conversion to electric cooking.

★ ★ ★

About 750 people are taking the opportunity of visiting the new Kingston power station which, as I mentioned a week or two ago, is holding "open house" for six days this month—Wednesdays and Fridays. On the first day 120 visitors were split up into parties of eight and shown around by members of the staff. There has been a local request that the station shall be open on Saturdays, but although this would enable more people to attend it would overburden the attenuated week-end staff. The provision of such opportunities for the inspection of power stations should lead to better public appreciation of the nature and problems of electricity production, and I would like to see it more widely adopted. It is not too easy to arrange without interfering with operations and it needs the co-operation of the staff. But most of us like talking about our jobs, and I should think this would be the least of the difficulties.

★ ★ ★

To a good many people this will seem to be a sound argument: a correspondent of the Hull *Daily Mail* points out that for one winter quarter the surcharge made by the Electricity Boards is 0.35d. per kWh; this is supposed to be compensated for by a reduction of 0.1d. per kWh in the other three quarters. Putting two and two together, the writer finds that in this way the Boards are "doing" the consumer for 0.05d per kWh. Strange are the uses of simple arithmetic.

★ ★ ★

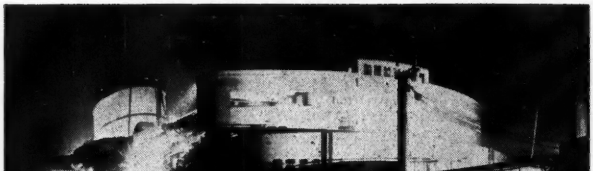
Progress in electronics is astonishing. The *Daily Mirror* has discovered a man who raises 6ft cabbages and tomato plants like small trees, and causes seeds to germinate in an hour—all by electronics. He sits "among wires, high-voltage cables and aerials," and "things happen." Things are not always satisfactory, however; he "shot a 5,000-volt ray into a marrow to fatten it. It grew twice as long. But no fatter than a cucumber." He healed a cut finger with his ray, but, he says, "afterwards I was sick and in bed for a week."

★ ★ ★

I like the avowedly true story I heard this week of the old lady in a remote area of the Highlands where electricity had recently been introduced. When the time came for the payment of the first account the meter reader commented on the fact that for the first three months the bill would be only seven shillings. To this the old lady replied: "Och, I only use the electric light to see to light my paraffin lamp."

The New "Caronia"

FIRST USE OF PASS-OUT AUXILIARY TURBINES



Exterior floodlighting on the new "Caronia"

JUST two years have been needed to complete what is believed to be the largest ocean liner built since the war. The new *Caronia*, which sailed on her maiden voyage from Southampton to New York on 4th January, is half as big again as her namesake of forty-four years ago. She is of dual-purpose design, fitted for world cruising without seriously detracting from her serviceability in the North Atlantic trade

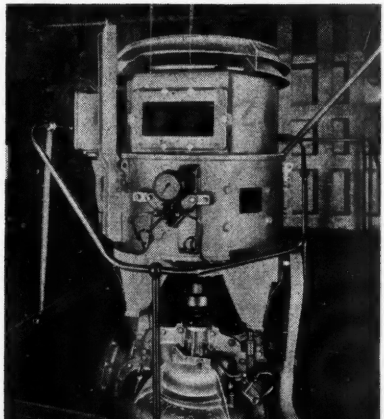
The hull was built on Clydebank by John Brown & Co., Ltd., being 715ft long and of 34,183 tons gross, 37,800 cu ft of cargo capacity, with accommodation for 932 passengers and 587 officers and crew.

Four shades of green are a break-away from the traditional black, white and red hull colouring of the Cunard White Star, Ltd. The single funnel, the largest fitted to a passenger ship, contains induced draught fans and wet flue dust collectors. Oil-fired Yarrow boilers generate steam at 550 lb/sq in and 780 deg F for two sets of triple expansion Parsons turbines which gear-drive twin propellers.

Auxiliary steam and electricity are furnished by four turbo-generators which are believed to be the first instance of the use in a British ship of pass-out machines to supply steam for the cooking galleys and other low-pressure services.

The sets were designed and made by W. H. Allen, Sons, & Co., Ltd. Each multi-stage impulse turbine is mounted directly upon its surface condenser and drives a compound-wound d.c. generator of 1,100 kW at 225 V through double helical gearing, 4,500/600 r.p.m. single reduction. The gear is force-lubricated, the pinion being on top of the wheel so as to keep turbine and generator on a single axis to facilitate flush mounting.

The sets take steam at the main pressure and temperature, each passing out up to 15,000 lb/hr at 60 lb/sq in pressure. The centrifugal type governors are unusual in that they regulate the oil relays of both input and pass-through steam valves so that they act in parallel.



One of four 50/100 h.p. circulating pump motors —Laurence, Scott

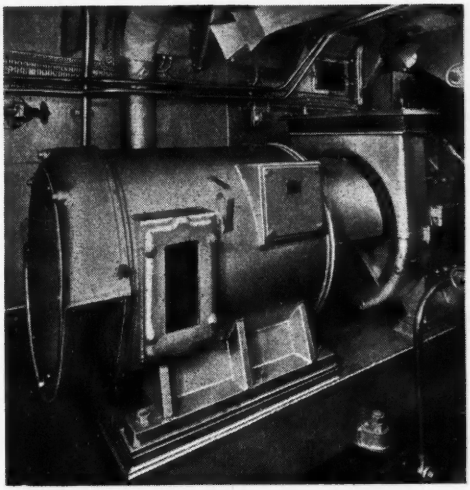
Engine and boiler room auxiliaries are, in the main, electrically driven. The switchboard is athwartships at the forward end of the engine room. It is 55ft long, 30ft of which consists of dynamo control panels and the rest feeder panels whence cables pass up to the port and starboard sides of the "A" deck for the hotel services distribution system, and to "C" deck for machinery requirements. The connecting cables form several ring mains with 26 auxiliary switchboards so disposed that each waterproof and fireproof section of the ship has its own. Thus the piercing of bulkheads is minimized. The whole of the fire-resisting insulated cable for the ring mains was supplied by W. T. Henley's Telegraph Works Co., Ltd. A steel alkaline "Alklum" accumulator by Britannia Batteries, Ltd., of 240 Ah capacity at 230 V, is provided for emergency services, including the steering gear.

Warping and windlass gear on deck is spur driven by vertical motors situated on the deck below, of Clarke Chapman make with Ward-Leonard booster control of all capstans and winches. The electro-hydraulic steering gear by Brown Bros., of Edinburgh, has two 70 h.p. motors by Laurence, Scott & Electromotors, Ltd., who supplied more than 200 motors totalling 4,000 h.p., of which 1,500 h.p. is made up of variable-speed machines, which is of interest in view of the growing tendency to favour a.c. for ships' auxiliaries. Among them are four of 50/100 h.p. for Drysdale circulating pumps, twelve of 30 to 75 h.p. for boiler fans, eight "Scott" cargo winches, four gangway hoists, two of 160 h.p. for the main compressors and others of 45 h.p. with Allen West starters for the freon refrigeration installation by J. & E. Hall, Ltd. There are 500 motors totalling 6,540 h.p. and ranging from 0.25 to 236 h.p.

Emergency generating plant consists of a 75 kW McLaren diesel driven Laurence, Scott dynamo in a compartment above the bulkhead deck with electric and compressed air quick starting gear, while another set of 132 h.p. aft on "A" deck has battery and air starting.

Two 2 kW motor generators serve the 25 V circuits, including 570 slave clocks controlled by an electrically wound chronometer by T. Mercer, Ltd. They are divided into three circuits connected to 18 relay boxes, each of the seventy relays controlling from three to eight clocks.

A stand-by source for the 25 V circuits is a 65 Ah "Neverfayle" battery of 22 "Nife" nickel-cadmium alkaline cells with an automatic change-over switch and charged from the ship's 220 V mains. The 25 V system also serves the fire alarms, stateroom call indicators, sub-



One of two 175 kVA motor-alternators for fluorescent lighting—Laurence, Scott

merged log and communication circuits.

There are four passenger lifts and ten others for baggage and stores, by the Express Lift Co., Ltd., with Laurence, Scott motors of 8 to 14 h.p. for speeds of 100-200 ft/m. The heating and ventilating system is by the Winsor Engineering Co., Ltd., including 400 "Thermovent" heaters of the 500 W multi-duct type and fans in cabins and staterooms. Seventeen air-conditioning plants represent the largest installation yet fitted in a ship, needing 200 h.p.; the fans are directly coupled to Metropolitan-Vickers variable speed motors.

The kitchens on the restaurant deck

can provide meals for 560 passengers at one sitting. The ranges are electric with "Torribar" elements of spill-proof type; there is also an electric range in the crew's kitchen. The confectioners' oven, boiling

Principal restaurant lighting—B.T.H. Co.

table, griddle plates, machines for mixing, washing, vegetable preparation, bacon slicing and burnishing silver are electric, generally supplied by H. Wilson & Co., Ltd. The bakery also has electric ovens and mixing machines. Apart from cold chambers for food storage, there are twelve domestic refrigerators, "Hallmark" cold-cupboard machines, ice-water systems and ice-cream plant.

There are 700 telephones, loud-speaking, manual and automatic, all of T.M.C. make with two G.E.C. switchboards; the 100-line automatic board is for inter-communication while the 600-line three-operator board is for passenger cabin service and has six shore-line connections as well as radio links. There is extensive public address, "K.B." broadcasting and music-relaying equipment with loudspeakers concealed behind the panelling in public rooms.

There are five transmitting and four receiving aerials for the radio-telegraphy installation and what is believed to be the first use of single-sideband radio telephony in marine service, made by Standard Telephones & Cables, Ltd., all installed by the International Marine Radio Co., which operates the Cunard White Star radio service. There are a rotating loop direction finder and emergency radio-telegraph outfits for the lifeboats.

There are two separate radar outfits, a Metropolitan-Vickers "Seascan" and an Admiralty No. 268 type. Other navigation equipment includes two master gyro-compasses operated from the ship's d.c. 220 V mains with "Kelvite" electric repeaters. The sounding machine for hand and motor working is of "Kelvite" design, and depth recorders fitted in the bottom shell with panels in the chart room are by the Submarine Signalling Co., Ltd. The electric telegraphs are of Siemens make, the searchlights by G. Kent, Ltd., and the "Tyfon" whistles by Brown Bros. have electric telemotor control.

Three-phase a.c. at 220 V is furnished by two Laurence, Scott 175 kVA motor-alternators in the turbo-generator room for the main radio equipment, and the fluorescent lighting; 1,300 tubes are employed, largely indirectly in public rooms, across the phases with the star point of the alternators earthed. More than 10,000 lamps are needed ordinarily and combined with decorative schemes.

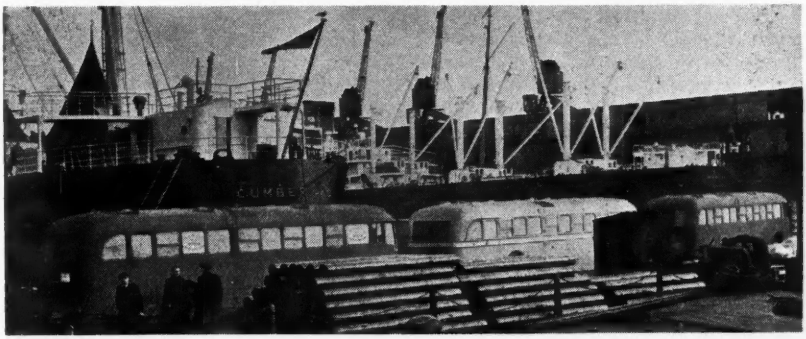
The effects achieved by Mr. J. P. McBride, of McInnes Gardner and Partners, the architects responsible for decoration, are enhanced by specially designed lighting fittings supplied by the British Thomson-Houston Co., Ltd. Sun-like colours result from the combination of "warm white" fluorescent tubes with filament lamps. Tables are floodlit by tungsten units set in the deckhead, the one-hundred fittings in the two main restaurants including spotlights over the entrances and decorative wall brackets designed for their particular positions.

Panelling of dark and light shades and illuminated sculptured glass panels are features. In the centre of the forward restaurant is a series of gilt fluorescent fittings, each designed in the form of the letter "L" for fixing against both bulkhead and deckhead.

Festooned fairy lights link tall standard lamps which surround the sun deck verandah café overlooking the swimming pool, while "Mazdalux" projectors floodlight the decks.

Trolley-Buses for New Zealand

THE first four single-deck trolley-buses out of a contract of fifty-five being carried out by Metropolitan-Vickers Electrical Co., Ltd., for Auckland, N.Z., were shipped on the s.s. *Cumberland* from Liverpool on 31st December. The electrical equipment is manufactured entirely by the M-V. Co. at Trafford Park and Sheffield and the bodywork by Metropolitan-Cammell Carriage and Wagon Co., Ltd., Birmingham, as sub-contractor. The vehicles will be an important addition to Auckland's trolley-bus fleet (all Metrovick), the first vehicles having been delivered in 1938.



The first consignment of fifty-five trolley-buses for Auckland, N.Z., being shipped by the S.S. "Cumberland"

Interesting features of the new buses are the location of the switchgear, which is of the line-operated electromagnetic type, located at the rear of the vehicle, where it is readily acccessible with two outward opening doors. Above the switchgear compartment are mounted two automatic trolley retrievers which operate immediately dewirement occurs and so prevent damage to overhead gear.

The M-V. stabilized rheostatic non-regenerative system of control is incorporated, ensuring complete safety of the equipment on supply lines from rectifier substations. The stabilizing effect of the rheostatic brake circuit prevents undue stress on the transmission, and automatic acceleration equipment is fitted to ensure the protection of the transmission and maintain the comfort of passengers under all conditions of service.

The main traction motor is a "Metrovick" type 210 of 135 h.p. A motor-generator gives a low voltage supply for battery charging and lighting purposes. Battery manœuvring features are included to enable the vehicle to be driven on battery in emergency or for depot shunting.

B.E.A. Schools

FOLLOWING the successful summer school held at Magdalen College, Oxford, last year, the British Electricity Authority and the Area Electricity Boards are organizing two schools for their employees this year. One is to be held at King's College, Cambridge, from 2nd to 9th April, and the other at Magdalen College, Oxford, from 1st to 9th July. A total of nearly 200 employees will attend the schools.

The District Joint Industrial Councils, District Joint Boards, and District Joint Councils have been asked to select from applicants those who are to attend the schools. The cost of travelling and board and accommodation will be borne by the Authority and Area Boards, and normal wages and salaries will be paid during attendance at the school.

The programmes will follow similar lines to those of last year's school, and certain speakers will be in the position to review the first year's working of the Authority and the Boards. An innovation will be the presentation of short papers by selected students on the nature of their own work. In addition, invitations are being sent to a

number of people outside the supply industry to give lectures on topics of general interest. The 107 students who attended the summer school at Oxford last year were invited to submit papers giving their general impressions with constructive suggestions as to the organization of future schools. About half of those who attended submitted papers which were judged under four categories—Executive, Clerical and Administrative, Technical, and Manual. The papers were of high quality and book prizes are being awarded to eight of the entrants.

Correspondence

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents

Institution Theses

IF the Institutions concerned could once and for all dispel the ignorant, sometimes damaging, taunt that admission to corporate membership by thesis is less meritorious than by examination, they would be rendering a service to critics, candidates, and themselves alike.

While it is true that candidates afforded this alternative have the advantage in choice of subject, a far deeper knowledge of the particular subject is required, backed by originality of scientific thought and technical general knowledge. The fact that barely 40 per cent of theses succeed surely speaks for itself.

To my knowledge, many candidates having failed, after repeated attempts to find even an acceptable *subject* for a thesis, have eventually sat for and sailed through the examination with comparative ease!

DISCRIMINATED
(M.I.E.E., A.M.I.Mech.E.).

Electricians' Wages

WITH regard to your leading article of 7th January, you will appreciate that upon a dispute being referred to the Ministry of Labour and National Service, the Minister decides as to whether or not it shall be referred to arbitration. In the case of the application of the Electrical Trades Union for an increase in wages, because of failure to agree by the National Joint Industrial Council, the Union referred the matter to the Minister. He in turn referred it to the National Arbitration Tribunal, and under the arrangements of that organization both parties to the dispute were called upon to deposit their "cases" a few days before the Tribunal met.

You have apparently received a copy of the case presented by the Electrical Trades Union; I enclose herewith a copy of the case presented by the National Federated Electrical Association. At the sitting of the Tribunal, each side had the opportunity of expressing views concerning the case submitted by the other. The "simple arithmetic" which you have mentioned in your leading article is, of course, obvious. The electrical contracting operations of the companies quoted by the Electrical Trades Union in their "cases" are somewhere about 5 per cent of the aggregate of the various businesses to which reference is made and even then certain of the figures quoted are entirely misleading.

In conclusion, I wonder if the suggestion contained in the final paragraph of your leading article under this heading is correct? I would venture to suggest that such is not the case.

London, W.C.2. L. C. PENWILL,
Director and Secretary,
NATIONAL FEDERATED ELECTRICAL ASSOCIATION.

[In the N.F.E.A. statement sent by Mr. Penwill it was contended that no increase in wages was justified in the light of the Government's economic policy; on the grounds of increased cost of living; or on the grounds of increased production. It was further maintained that the high cost of installation work was preventing the placing of contracts although much work was waiting to be done.—Editors, ELECTRICAL REVIEW.]

Electricity Output

THE Ministry of Fuel and Power statement for the week ended 31st December last shows that 917.6 million kWh was sent out for public supply from solid fuel-fired stations, as compared with 1,005.9 million kWh (amended figure) in the preceding week, and 873.3 million in the week ended 2nd January, 1948.

The total kWh sent out in 1948 was 42,240 millions, as compared with 38,876.6 millions for 1947.

Stocks of coal at electricity undertakings at 1st January amounted to 3,919,700 tons.

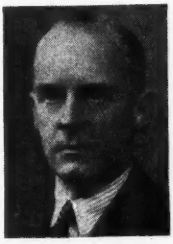
PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Metropolitan-Vickers Electrical Export Co., Ltd., announces that **Mr. J. F. Perry** has been appointed managing director and **Mr. F. J. E. Tearle** general manager as from 1st January.

Mr. Perry joined the then British Westinghouse Co. in 1913. He rendered valuable service to the French Reconstruction Committee in replanning the devastated collieries in the north of France after the 1914-18 war and he has since travelled extensively in Australia, Africa and Europe in connection with M.-V. mining interests. In 1932 he and Dr. D. M. Smith jointly

Mr. J. F. Perry



Mr. F. J. E. Tearle

received the Thomas Hawksley Premium of the Institution of Mechanical Engineers for their paper on "Mechanical Braking and its Influence on Winding Equipment." Three years later Mr. Perry became sales manager, Plant Department, relinquishing that position in 1945 to become general manager of the Export Co., of which he had been made a director in the previous year. He was recently decorated by the Portuguese Government as Comendador da Ordem Militar de Cristo in recognition of his engineering services in connection with hydro-electric schemes in that country.

Mr. Tearle was educated at Osborne and Dartmouth and served in the Royal Navy in 1919-20. After a college apprenticeship at Trafford Park he went to Russia on erection work in 1925 and joined the Export Co. the following year. He continued to work in Russia, with one interval, till 1933, and during his last three years there he was manager of the Leningrad office. In the last war Mr. Tearle saw naval service as a lieutenant, R.N.V.R., but was recalled from the Middle East at the end of 1942 to take charge of some special contracts. In 1944 he was appointed principal representative of the Export Co. at the Trafford Park works and a year later he joined that company's board. Since March, 1947, he has acted as special assistant to the Metropolitan-Vickers management.

Mr. W. G. Crocker, A.C.G.I., D.I.C., M.I.E.E., has been appointed technical director of Bryce, Ltd., Kelvin Works, Hackbridge, Surrey. For the past eleven years he has been employed as works manager and chief engineer to the Metropolitan Electric Cable & Construction Co., Ltd. He received his early training as an apprentice in H.M. Dockyard, Devonport, and in 1924, after four years' education at H.M. Dockyard School, was awarded a Royal Scholarship at the Imperial College of Science and Technology (City and Guilds). Upon leaving college he was employed by Callender's Cable & Construction Co., Ltd., in the Research Department, and later transferred to the Erith works as senior technical officer, and finally as assistant to the works manager.

Mr. M. D. Millington, formerly of British Insulated Callender's Cables, Ltd., Prescot, has been appointed works manager at the works in Manchester of Associated Technical Manufacturers, Ltd.

Sir John Russell, the eminent authority on soil chemistry, was installed last week as president of the British Association for the Advancement of Science in succession to Sir Henry Tizard.

Mr. R. C. Dawson has joined the London and the South territorial office of the English Electric Co., Ltd., Queen's House, Kingsway, W.C.2, to take charge of industrial motor sales in the area. Following his apprenticeship with Bull Motors (E. R. & F. Turner, Ltd.) he was attached to their Sales Department at Ipswich and London and was later appointed manager of the London branch. During part of the war he served in the D.I.E.E. Machine Tool Control.

Mr. R. C. Dawson

Mr. T. D. Martin, who has ended his association with the Nelson electricity undertaking after eighteen years as the borough electrical engineer, proposes to set up as a consulting engineer. He was president of the Electrical Power Engineers' Association in 1928-29 Mr. Martin was recently the guest of honour at a farewell dinner

given to him by the employees of the Nelson undertaking.

Mr. E. Bates has been appointed deputy chief commercial officer to the Eastern Electricity Board. Before vesting date he was consumers' engineer at Luton, and has been with the Board since that date.

Mr. H. L. M. Dent, of Swindon generating station, has been appointed shift charge engineer at Castle Meads generating station, Gloucester. Mr. Dent received his technical training at the Rugby College of Technology and Arts and Manchester Technical College. Following his apprenticeship with the English Electric Co. at Rugby, he remained with the company in the Water Turbine Section. Later he served with Manchester Corporation at Stuart Street generating station.

Mr. O. H. Smith and **Mr. C. L. Dalziel** have resigned from the board of Associated Electrical Industries, Ltd., and the directors have nominated **Sir Robert Renwick** and **Mr. J. Babington Smith** to fill the vacancies.

Mr. P. S. Bayliss and **Mr. F. W. Bayliss** have retired from Bayliss, Jones & Bayliss, Ltd., and **Mr. F. Usher-Smith** and **Mr. R. M. Hyslop** have been appointed managing directors as from 1st January.

Mr. R. Childs, export manager of Thorn Electrical Industries, Ltd., has just returned from a second overseas tour.

Mr. H. C. Siddeley, of H. A. Roberts & Co., Buenos Aires, is visiting this country and expects to arrive here about the end of the month. His address will be Goring Hotel, Ebury Street, London, S.W.1.

Lord McGowan, K.B.E., D.C.L., LL.D., chairman of Imperial Chemical Industries, Ltd., has accepted an invitation to become the first patron of the Purchasing Officers' Association.

The Ekco Social and Sports Club (**E. K. Cole, Ltd.**), held its annual children's Christmas party at the works canteen on 7th January. Over 670 children enjoyed a full afternoon of fun and amusement, with an ample supply of good things to eat. The highlight of the afternoon was the appearance of Santa Claus, played this year by Mr. J. Hunt, works manager, Ekco-Ensign Electric, Ltd., with a toy for every boy and girl.

The directors of **Falk, Stadelmann & Co., Ltd.,** gave an inauguration luncheon to the office and warehouse staff on 23rd December last, to celebrate the opening of the new canteen which has recently been established at the head office, 91, Farringdon Road, E.C.1. Mr. Hugo Falk, the chairman, presided.

The sixth annual dinner of the High Tension Test Department of **A. Reyrolle & Co., Ltd.,** the first held since the war, was attended by former employees from various parts of the country. Mr. R. Rumbles, superintendent of the Department, presided and proposed the toast of the Department, to which Mr. T. W. Green replied. Entertainment was provided by members of the company.

On 5th January at the head office of Johnson, Matthey & Co., Ltd., Hatton Garden, London, a pleasing ceremony took place on the occasion of a presentation to **Mr. G. C. H. Matthey** who, after forty-five years' service with the company, is retiring from the executive committee of directors. He continues, however, as a member of the general board of directors. The presentation

Mr. G. C. H. Matthey with his portrait in oils and his horse "Teddy"

which took the form of the gift of his portrait in oils, and of his favourite horse, "Teddy," who has for some years been employed in drawing one of the company's city vans, was subscribed to by the whole of the 3,000 employees of the company from all its branches in the United Kingdom. The occasion was attended by nearly 400 representatives of the works and staff.

Mr. Ian Cameron has been appointed to the board of Clifton Aircraft, Ltd., from 1st January as sales director. Mr. Cameron joined the Appliance Division early in 1945 as sales and development manager. Before moving to Lytham he was well known in the north-east having represented the English Electric Co., Ltd., and Simplex Electric Co., Ltd., for many years in the Yorkshire area. **Mr. W. H. Langstone,** who joined the company as chief designer in 1945, has been appointed works manager. Mr. Langstone has been associated with the manu-

facture of domestic appliances for many years, having previously held posts in the Design Department of the English Electric Co., Ltd., Johnson & Phillips, and the General Electric Co., Ltd.

The apprentices of the Willesden works of **Lancashire Dynamo & Crypto, Ltd.,** were recently entertained to dinner by the company at the Abbey Hotel, Stonebridge, together with their sponsors, foremen and senior executives. The chairman, Mr. D. C. Lorkin (director), welcomed the new apprentices who were attending the annual dinner for the first time and congratulated those who were completing their training. After dinner Mr. V. G. Robins (test superintendent) proposed the toast of "The Apprentices." After a reply from Mr. R. L. K. Trimmer (senior apprentice) the "F.H.S." silver cup for the best all round apprentice for 1948 was presented to Mr. T. Lawson by Mr. Lorkin. Mr. R. T. Sutton proposed the toast of the company, and the chairman, in replying on behalf of the board, referred to the fact that next year was the fiftieth anniversary of the company's formation, and he looked forward to meeting them all again at the jubilee festival next March. He concluded by presenting a gold watch to Mr. R. T. Sutton, who had completed twenty-five years' service with the company.

Obituary

Mrs. W. R. Rawlings.—We extend our sympathy to Mr. W. R. Rawlings, a past-president of the Electrical Contractors' Association, in the loss of his wife, Mrs. Mary Rawlings. They were married 63 years ago.

Mr. G. C. Hibbert.—The death occurred on 7th January, at the age of forty-eight, of Mr. Geoffrey C. Hibbert, director and general manager of E. H. Jones (Machine Tools), Ltd. Mr. Hibbert had held the position of leading executive with the organization for the last three years. The interment took place at Golders Green Crematorium on 12th January.

Mr. E. T. C. Coxon.—The death occurred on 6th January in a nursing home of Mr. E. T. C. Coxon, Midlands, South Wales and South-Western area representative of Burco, Ltd.

Wills

Mr. A. E. Moody, organizer of "Radiolympia" since 1928, formerly joint sales director of the British Thomson-Houston Co., Ltd., who died on 1st August last, intestate, left £5,451 gross (net value nil).

Mr. J. Carter, a director of J. Carter & Sons (Bradford), Ltd., electrical contractors, who died on 11th August, 1947, intestate, left £3,713 gross (£3,634 net).

Mr. H. R. Wright, A.M.I.E.E., assistant power station superintendent at the Prince of Wales generating station, Rotherham, who died on 22nd July, left £4,042 gross (£4,002 net).

Mr. K. F. Bishop, formerly deputy borough electrical engineer of Warrington, who died on 17th October last, left £3,842 gross (£3,784 net).

Mr. M. Black, J.P., managing director of Michael Black, Ltd., wholesale radio and electrical merchants, who died on 17th July last, left personal estate in England and Scotland valued at £14,799.

Mr. H. G. Ward, director and secretary of Rowlands Electrical Accessories, Ltd., who died on 23rd July last, left £4,954 gross (£4,895 net).

Mr. G. E. Turner, of Blackburn, electrical engineer, who died on 16th October last, left £15,468 gross (£15,375 net).

Consultative Councils

THE Minister of Fuel and Power has announced the names of the members of two further Electricity Consultative Councils.

The chairman of the London Area Council is Ald. L. J. Hayward, and the deputy chairman Mr. C. A. Crossle, while the members include Ald. Mrs. Gregory, a former chairman of the Electrical Association for Women, Mayor of West Ham in 1942, and a past chairman of the West Ham Electricity Committee, and Mr. F. C. Polden, of Francis Polden & Co., Ltd., electrical contractors.

The North Western Area Council members include Ald. Wright Robinson (chairman) and Ald. C. A. Critchley, former chairman of the Blackburn Corporation Electricity Committee and a local authority member of the I.M.E.A. Council.

For the North-Eastern Area, the chairman is Mr. W. S. Hall (Durham), and the deputy chairman, Councillor H. Storry (Scarborough). The members include Mr. C. B. Chartres, C.B.E., M.I.E.E. (Glendale), Mr. R. W. Gregory, M.I.E.E. (Hexham), and Viscount Ridley, chairman of the former North-Eastern Electric Supply Co., Ltd.

The East Midland Area chairman is Mr. L. L. P. Baston (Market Deeping), and the deputy chairman Mr. K. King (Irnham). Members include Mr. A. Brookes, M.Eng., M.I.E.E. (Beeston), and Mr. C. F. Freeman, B.Sc., M.I.E.E. (Coventry).

The chairman of the South-West Scotland Area is Bailie A. B. Mackay (Glasgow), and the members include Mr. J. Jameson, M.I.E.E., A.M.I.Mech.E., M.I.H.V.E. (Glasgow), and Mrs. A. E. McColl (Dumbarton).

New Quartz-Metal Seal

Increasing Capacity of Conductors Without Impairing Hermetic Qualities

By E. H. NELSON

(Research Laboratories of the General Electric Co., Ltd., Wembley)

IN the development of very high wattage mercury-vapour discharge lamps having vitreous-silica envelopes, seals have been necessary which can carry currents of the order of 300 A to the electrodes.[1, 2, 3] These seals must be capable of continuous operation in air at 400 deg C (750 deg F) and contain no pockets in which appreciable quantities of mercury can condense.

Transparent vitreous silica, referred to henceforth for brevity as "quartz," is highly transparent both to visible and to ultra-violet light. Its softening point under vacuum is about 1,200 deg C (2,190 deg F), the coefficient of thermal expansion is around $c.5 \times 10^{-6}$ and the material may be worked like common glass in an oxy-hydrogen flame. These properties, unapproached by any other known transparent material, make quartz peculiarly suitable for very high wattage lamps. The wattage dissipation in free air may be as high as 35 W per sq cm, enabling lamps of as much as 25,000 W rating to be made in spherical bulbs some 15 cm in diameter. Such quartz lamps, having ratings from 40 to 50,000 W, have been developed in laboratories in England over the past dozen years.

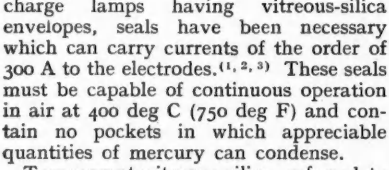


Fig. 1.—Details of earlier types, showing lead seal (left) and foil seal (right)

The very low coefficient of expansion of quartz and its high working temperature have so far ruled out the technique used for making seals through common glasses, where the metal is matched in coefficient of expansion to the glass employed and the glass is softened round the metal by heating, usually in a blowpipe flame. No metal is known having a coefficient of expansion similar to that of quartz and able to withstand the high working temperature.

In one of the earliest forms of quartz-metal seal (Fig. 1 (a)), still extensively used, the principle consists essentially in sealing the quartz container from the surrounding air by a lead plug (1) which is poured while molten into a chamber shaped in the seal tube (2). On freezing, the lead adheres to the quartz wall and may be used as part of the electrically conducting path in conjunction with metal pieces (3) extending into the device and out to the surrounding air. The high malleability of lead allows expansion and contraction to take place due to thermal changes without breaking the lead-quartz bond. Clearly this seal will not operate at temperatures above the melting point of lead; this makes it unsuitable for high-wattage devices where the heat conducted along the seal itself, or from the surrounding air, may raise its temperature to several hundred degrees C unless it is made disproportionately long or is elaborately cooled.

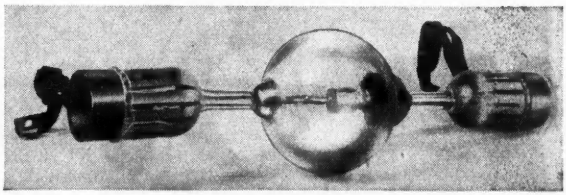


Fig. 2.—Mercury-vapour lamp of 75,000 W rating with 300A foil seals; bulb 15 cm in diameter

A more successful seal (Fig. 1 (b)[4]) uses a strip of molybdenum foil (4), 0.015 mm thick by 1 mm wide by 10 mm long. This foil has conducting leads (5) attached at each end and the assembly is enclosed in a close-fitting evacuated quartz tube (6) which is then strongly heated around the foil with an oxy-coal-gas blowpipe. The softened quartz collapses on to the foil and makes such intimate contact that, on opening the tube at one end, no air will leak along the interfaces.

With a material such as molybdenum or tungsten used for the exposed lead, the seal will operate in free air at temperatures up to about 400 deg C, when the molybdenum foil begins to oxidize at the exposed end. Owing to the very small cross-section of the foil, the stress set up by the differential expansion of metal and quartz is not sufficient to cause the quartz to crack, even at a temperature approaching red heat. Such seals will satisfactorily carry some 2 A continuously with one end exposed to air.

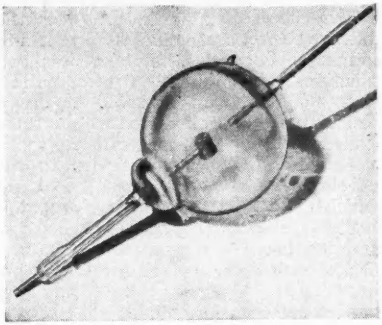


Fig. 4.—Mercury-vapour lamp with 400A disc seals; rating and diameter as in Fig. 2

2 shows a 25,000 W mercury-vapour lamp with two 300 A seals having 16 foils, each capable of carrying about 20 A.

Foil seals have been widely used for many years in the manufacture of quartz mercury-vapour lamps, various other methods[6] not having so far found widespread use. The graded-seal technique for

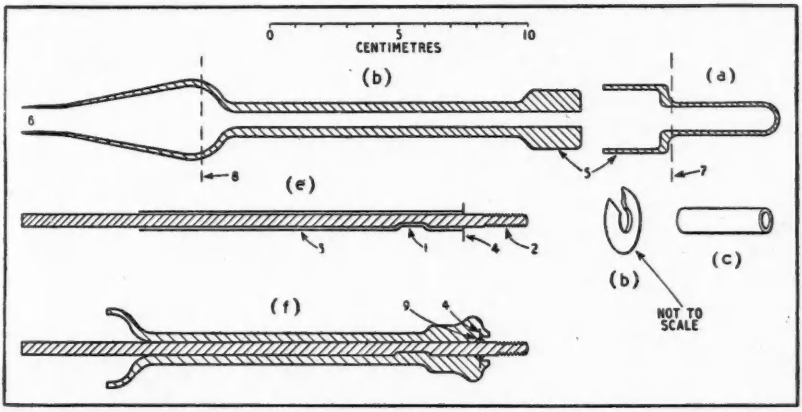


Fig. 3.—Construction and assembly of new disc seal

Development work showed that careful shaping of the foil to a lenticular cross section enabled much larger foils to be sealed through quartz, proportionately increasing the current-carrying capacity[5]; e.g., foils 8 mm wide having an average thickness of 0.03 mm will carry about 20 A continuously. With several such foils in parallel, current capacity may be further increased. Fig. instance, is not generally acceptable for such lamps owing to its high cost, its sensitivity to severe thermal shock, and the difficulty of avoiding pockets in which mercury vapour could condense[7].

A seal has two functions to perform. It must conduct electric current and it must exclude gas from the device to which it is attached. In the seals so far described, these functions are performed

by the same metallic body. Thus the foil in the foil seal conveys current and forms the hermetic seal, but these two functions are mutually incompatible since the cross-section should be heavy to carry large currents, but at the same time must be restricted in order to make a hermetic seal. This has led to the development of the "disc" seal, in which the two functions are separated.

Fig. 3 shows in diagram form a disc seal capable of carrying 400 A. continuously in air at about 400 deg C, for use in a 25,000 W high-pressure mercury-vapour lamp made entirely of quartz.

Two pieces of quartz (a and b) are shaped from tubing, using an oxy-hydrogen blowpipe. The molybdenum rod (e) is cut to length; indented at a convenient point (1); screwed ¼in Whitworth thread at one end (2); cleaned, and covered as shown with a wrapping of molybdenum sheet (3). The screwed end is merely to facilitate the attachment of lamp caps or connections.

The disc (d) is stamped from 0.05-mm molybdenum sheet and shaped by etching to the form shown. The disc, after cleaning, is placed on the rod in the position shown at (4) in (e) and the assembly slid into quartz piece (b) with the disc resting on the top of this piece. The molybdenum cylinder shown at (c) has a wall thickness of 2 mm and is wrapped with thin molybdenum foil. It is slipped over the protruding threaded portion of the seal rod and covered with the quartz piece (a) which slides over quartz piece (b). The edge of piece (a) is joined to the body of piece (b) at (5) with a blowpipe flame, the interior of the assembly being filled with an inert gas to prevent oxidation of the metal.

The assembly is evacuated from, and sealed off at, point (6) and is then strongly heated in an oxy-hydrogen flame in order to cause the quartz to collapse on to the disc and rod. The wrapping round the rod prevents the softened quartz from sticking to the rod, and subsequently cracking when the rod cools and contracts relatively to the quartz. The indentation in the rod allows softened quartz to flow in and key the rod against twisting or longitudinal movement.

After the quartz has collapsed, it is cut away above the point (7) and the molybdenum cylinder is extracted. This leaves an annular space 2 mm wide in which the junction of the disc and rod is visible and accessible. The quartz is also cut away at (8) where the seal has subsequently to be joined to the lamp bulb. The final operation consists of heating the assembly (f) around the disc (4) in an inert or reducing atmosphere to about 900 deg C, and applying solder to the joint of rod and disc (9). Many materials may be used to make this joint, depending on the function of the seal.

In Fig. 3 (f), which shows a longitudinal section through a completed seal, the current-carrying member consists of a continuous rod of metal, e.g., molybdenum, 6 mm in diameter. This is adequate in cross-section for carrying 400 A. The hermetic member consists of a molybdenum disc (4) through which the molybdenum rod passes. This disc is shaped to a lenticular cross-section and has its periphery embedded in quartz so that gas cannot leak from one side of the seal to another across this outer edge. Similar leakage where the molybdenum rod passes through it is prevented by soldering or brazing the point at (9).

Since the current-carrying capacity of the seal is limited only by the diameter of the rod employed, it should be possible to make seals to carry several thousands of amperes. The delicacy of the disc in no way impairs current capacity.

The seal described has been developed for use with high-pressure mercury-vapour lamps, but it has features which may make it of considerable value in many applications. It has been found to exceed in capacity any quartz-metal seals yet made that are capable of withstanding the high temperatures associated with heavy currents. The methods described in this article could, no doubt, be extended to the manufacture of hermetic quartz-metal seals having a much higher current-carrying capacity.

This seal was designed in the G.E.C. Research Laboratories.

BIBLIOGRAPHY

(1) Aldington, J. N: *Trans. I.E.S.*, London, 1946, 11, p. 11.
(2) Bourne, H. K.: *Photographic Journal*, 1943, 83, p. 135.
(3) Nelson, E. H.: *G.E.C. Journal*, 1946, 14, p. 73.
(4) Patents Nos. 396,103; 476,488; 489,534; 489,626; 489,630.
(5) E.g., Patents Nos. 511,879; 512,941; 588,184; 579,415.
(6) E.g., Patents Nos. 512,257; 563,027; 573,025.
(7) E.g., Patent No. 494,447.

Permanent Magnets

Magnetization of Awkward Shapes

By W. E. BURNAND, M.I.E.E.

THE ever widening use of permanent magnets has introduced many problems in magnetization. Carbon steel magnets, later followed by tungsten, confined to straight and horseshoe shapes, were readily dealt with: first by stroking them in suitable directions with permanent magnets, next by placing them across the poles of an electro-magnet, and later by a combination of solenoids and electro-magnets. The advent of cobalt steel, aluminium and other alloys and the shapes rendered possible by casting, outstripped the possibilities of these devices.

Simply stated, the problem is to get sufficient magnetizing force in the required direction at the lowest overall cost. Difficulties arise due to the small spaces available for magnetizing coils and interference between various parts of the magnet during the magnetizing operation. The cost and the method to be used is conditioned by the quantity of magnets of similar size and shape to be dealt with.

In the "pot" type of magnet used in loudspeakers, Fig. 1(a), the cylinder is the permanent magnet, the centre column and ends being soft iron to complete the circuit, except for the small annular air-gap "A." When the dimension B-C is short this type can be magnetized by placing it between the poles of a powerful electro-magnet, Fig. 1(b), whereas if this dimension is long the reluctance will be such that the middle section will not become fully magnetized. From the ampere-turns viewpoint the most efficient way of magnetizing the assembly would be to fill the space between the centre core and inner surface of the annular magnet with an insulated copper coil and pass sufficient current round it. This is not an economic way owing to the difficulty of removing the coil after magnetizing. A variation that is used to some extent is to insert a small coil, working it at a high current density (over 20,000 A per sq in) for the short period of magnetizing, leaving the coil inside. This, again, is expensive and, while allowable for small numbers, is not practicable when one is dealing with thousands.

A calculation of the ampere-turns needed for magnetization can be misleading as it is seldom possible to place them all in the most advantageous position relative to the magnet. Magnetizing between the poles of a magnet is apt to leave the middle portion not fully saturated, while a coil or solenoid may not fully saturate the ends unless the coil is longer than is often practicable. Therefore, a combination of the two is normally most useful. To take the length of the magnet multiplied by its coercive force as the measure of H needed to magnetize is also misleading. Anything from two to eight times that value may be needed, according to the shape of the magnet and the disposition of the coils and magnetizing poles.

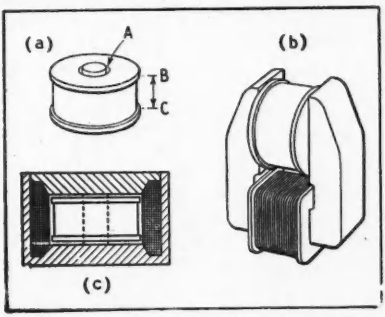


Fig. 1.—(a) Loudspeaker "pot" magnet. Magnetizing by placing it (b) between the poles of a powerful electro-magnet and (c) inside a substantial soft iron cylinder closed at the ends and containing suitable windings

A successful arrangement for dealing with "pot" magnets, Fig. 1(c), consists of a substantial soft iron cylinder, closed at the bottom, with a polepiece extending upward. A top portion matches, except that it is free to slide vertically inside the main cylinder, the space accommodating

the exciting winding. In practice the top structure is lifted out and replaced when the magnet is in position. Current is then "flashed" in the coil for 0.05 to 0.1 sec.

As this assembly is required to saturate the centre core as well as to allow for at least double the flux that the magnet and its core can carry in parallel, the iron part of the fixture, or jig, has to be correspondingly massive. On particularly large magnets, a lever system is provided to pull up the top part of the jig, which requires too big a pull for easy direct lifting after magnetizing.

It will be appreciated that with large magnets, particularly those of such a shape that the magnetizing coils cannot be well placed, considerable power is required; I have seen 360 kW used on magnets weighing less than 1 lb. Switching then becomes an expensive item. As the power is required only momentarily, some sort of storage is indicated, usually capacitive, or electro-magnetic. The latter is generally most useful because the resistance to be overcome in magnetizing

Fig. 2.—Typical magnetizing transformer

consists of hysteresis and eddy currents, the first being an essential property of the magnet. The second does not serve any useful purpose, so it should be kept as small as is possible.

Roughly, the power required varies as the square of the rate of change of flux,

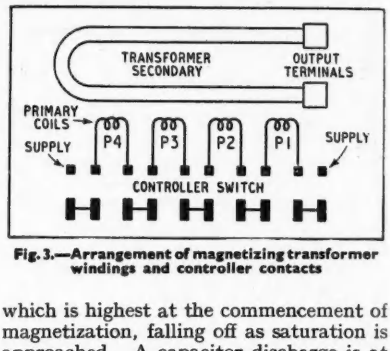


Fig. 3.—Arrangement of magnetizing transformer windings and controller contacts

which is highest at the commencement of magnetization, falling off as saturation is approached. A capacitor discharge is at its maximum at the start, diminishing rapidly thereafter. The discharge from a transformer, which is used as the means of electro-magnetic storage, does not build up instantaneously, due to self-induction, but rises rapidly from zero to maximum, at which point its work is substantially completed, tapering off thereafter, the rate of rise closely following the rate for minimum eddy loss.

The transformer also has the advantage that it can furnish a large current output at low-voltage, thus facilitating most operations with a single turn of conductor and often with a single straight bar of such high conductivity that it need not be insulated. This omission of insulation ensures the largest possible space for the energizing ampere-turns and reduces the power required, the wattage increasing proportionately to resistance and inversely as the space factor for a given H value. This permits a robust structure, which is of the utmost importance when the equipment has to be operated continuously by unskilled labour.

As the core of the transformer is much more massive than the magnet to be energized, it is necessary that any stray flux from the secondary winding shall be minimized. The self-inductance of the primary should also be reduced to the minimum, to keep down the inductive rise of voltage which wears contacts and reduces output. For these reasons I usu-

ally employ the square-cored type with a coil on each of the four slides, Fig. 2, approximately triangular in cross section. The core is not built up in the form of a solid square, but has an air gap (usually about 0.375 in.) at each corner to give the demagnetizing effect, or rapid collapse of flux to provide the acting discharge current in the secondary. This is the best place for air gaps, as it is where the spread of flux at the sides of the gap has its lowest linkage with the windings.

The primary winding is in four sections connected in series, Fig. 3, P.1 to 4, with ten breaks in the controller circuit to allow a rapid rate of break without great rapidity of movement of the controller handle.

To avoid excessive voltage rises if the primary circuit is broken with the secondary circuit open, a spring clip is provided, usually holding two thicknesses of paper, connected across each section of the primary. The paper punctures with excessive voltage rise, thus limiting it to a safe value. Sometimes a normally open coil-operated contactor is used in place of, or supplementary to, the hand controller.

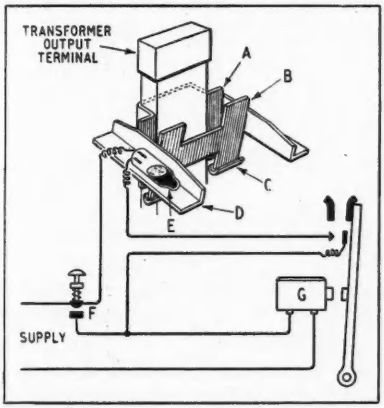


Fig. 4.—Timing device for use in conjunction with magnetizing transformer

A timing device, Fig. 4, consists of a soft iron member A round the connections to one of the transformer output terminals. Separated from it is another soft iron member B pivoted at C, which carries a light cross member D supporting a small mercury switch E. The depression of the foot switch F closes the circuit of the actuating coil G, causing the contactor to complete the transformer primary circuit. A current then flows through the secondary, assuming that it is closed, magnetizing A, attracting B with rocker D, and causing the mercury switch E to close. The latter, being in parallel with the foot switch, keeps the contactor closed until current ceases to flow in the connection round which A is clamped.

This current ceases when the core is saturated. The rocking system then moves gently back, being retarded somewhat by inertia and the dashpot effect of the rocker. When the mercury switch opens the circuit of the contactor coil, Fig. 3, all ten breaks open, rapidly interrupting the primary current to cause the working discharge of the transformer. If, however, the secondary of the transformer has been left open, current will not flow through the connection which magnetizes A, so the rocker will not be actuated and the contactor will trip immediately the foot switch is released, thus preventing full build-up of voltage.

It is possible in this way to get a 90 kW kick with a 3 kW input, which is the right "shape" for the purpose, gentle at the moment of start, when the magnet has its maximum permeability, with its maximum as the magnet reaches saturation. This enables many shapes of magnets to be dealt with on a commercial basis, which would otherwise be difficult.

Using the transformer method, the "pot" magnet can be magnetized in the jig, Fig. 1(c), with a single turn of many stout copper wires in parallel or a cop-

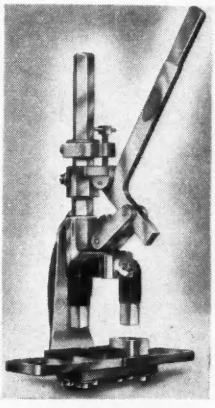


Fig. 5.—Toggle jig for use with meter brake magnets

per bar, filling the space allowed for the coil. The conductor should completely encircle the magnet, otherwise there will be a section not subject to the full magnetizing action of the coil.

Meter brake magnets can be either threaded on to a copper bar with a suitable clamping arrangement to make contact with the transformer output terminals, or placed in a toggle jig, Fig. 5, which is simply a quick way of threading a heavy conductor into and out of the magnet. The heaviest conductor which can be passed into the magnet should be used and the contact pressure must usually exceed one ton per sq in.

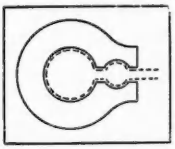


Fig. 6.—A cast magnet of this shape is energized by a current carrying conductor which fits the whole inside space

A cast magnet, Fig. 6, may be dealt with in a similar manner. The pole pieces are of active magnetic material, not soft iron as in older magnets of this type. A conductor in the round working space would therefore make it a small four-pole magnet, while a conductor in the main bend would make it the desired two-pole magnet. There would, however, be leakage across the first two points of the magnet which, combined with the restriction in the centre of the working space, would not fully saturate the final ends. To achieve full utilization, it is necessary to have conductors in both positions. In the jig, this requires that the parts on which the magnets are placed approximately fits the whole inside space. When the working space between the magnet poles is a large proportion of the total, a balance has to be kept between the two and the working space only partly filled.

An awkward magnet is Fig. 7, where the number of poles and the small space between them make it very difficult to accommodate a magnetizing winding, requiring considerable H in a very small space. The problem is overcome by using a jig, Fig. 7(b), which consists of an iron core with slots opposite the spaces between the magnet poles. Filling the slots and spaces in the magnet structure are bare copper conductors, connected five in parallel and making two turns round their respective cores. The top U.s of the conductors are bent over towards the centre of the jig, so that a specially shaped keeper can be placed on it to withdraw the magnets without breaking the magnetic circuit.

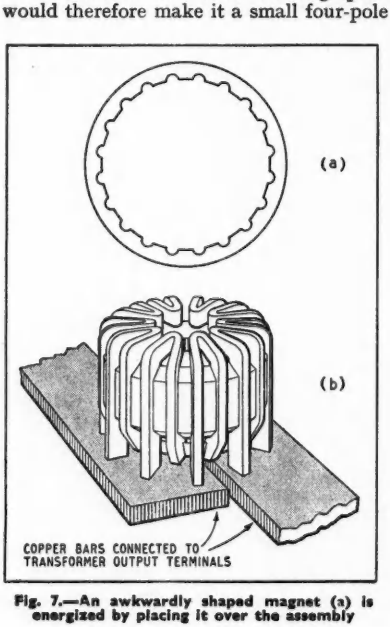


Fig. 7.—An awkwardly shaped magnet (a) is energized by placing it over the assembly

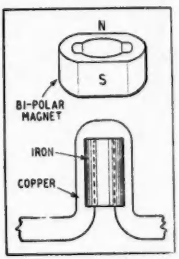


Fig. 8.—Bipolar generator magnet and a suitable magnetizing assembly

The small bipolar generator magnet, Fig. 8, is another awkward shape to magnetize by most methods (due to the whole being of active magnetic material), but easy by the transformer method. This involves a loop of copper, of as large a cross section as can readily be passed into the space available, with an "H" section armature in the loop, the whole being an easy fit in the magnets, which are slipped two at a time on the magnetizing assembly, Fig. 8, lower part, the copper loop being bolted to the transformer output terminals. The transformer is switched on and off to magnetize, after which

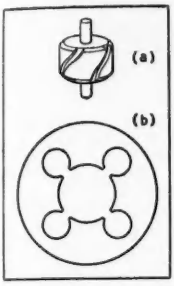


Fig. 9.—Four-pole rotor (a) and a satisfactory jig shape (b)

the magnets are replaced by the next two, and so on, without manipulation of the jig itself.

In the case of a four-pole rotor, Fig. 9, with a length of magnetic circuit from pole to pole that is small in proportion to the cross section, the space for exciting windings is not limited. With more space available, less power is needed for a given H, so the transformer method is not so advantageous. A jig, Fig. 9(b), is usually satisfactory in this case. There is a balance of the best proportion between iron and copper, due to magnetic leakage, the balance being affected by the rate of input. For maximum effect the iron has to be of ample size to carry the useful flux plus the larger leakage flux. The reduced space which is then available for windings demands a greater power input and a compromise has to be effected according to the size and material of the magnet.

Simple horseshoes of medium coercivity (cobalt steel) can be magnetized by placing a batch of anything up to fifty on a copper bar, giving the latter a flash on

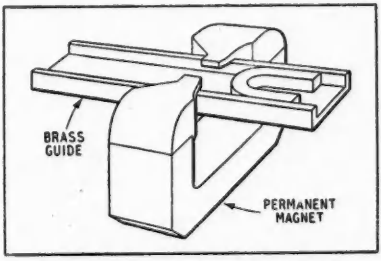


Fig. 10.—Energizing horseshoe magnets

the transformer, or small sizes can be passed through the pole-pieces of a powerful permanent magnet, Fig. 10. As an indication of the allowance for leakage, the pole-pieces start with a cross section of 2 sq in where they are attached to the permanent magnet, and finish with a cross section of 0.2 sq in at the point of application.

With all magnets it is advisable to perform the magnetizing operation at the latest possible stage of manufacture, as the facility with which they can pick up

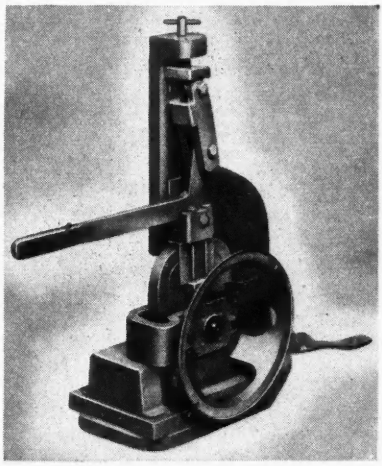


Fig. 11.—Jig for magnetizing the magnets on completed loudspeakers

unwanted bits of magnetic material and the trouble which this can cause is exasperating and expensive to a degree only comprehended by those familiar with the work. Nevertheless, the magnet of one type of loudspeaker can be magnetized, Fig. 11, after assembly of the cone and speech coil without any great voltage being induced in the latter during the operation. The magnets in a telephone receiver may also be magnetized (Fig. 12) after completion. In this case the jig is merely a flat copper bar across the trans-

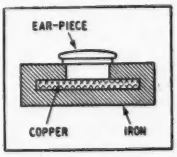


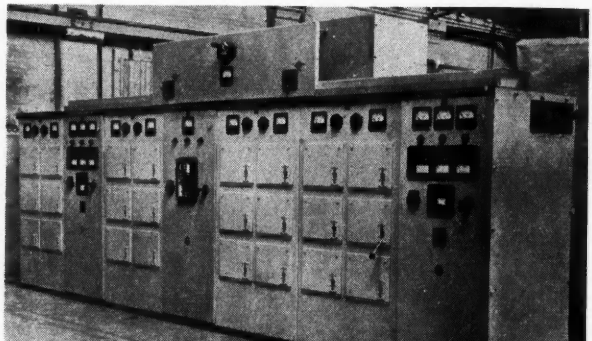
Fig. 12.—Telephone receiver magnets can also be energized after assembly

former output terminals, with a soft iron shroud having an opening at the top side to take the telephone receivers. In this instance the magnets are energized by the combined effect of the current in the bar and the poles formed in the iron shroud.

Manufacturing Progress

RECENT ORDERS FOR HOME AND OVERSEAS

THE first of a new range of axial-flow turbines to be completed by the **Brush Electrical Engineering Co., Ltd.,** is being supplied with transformers and high and low voltage switchgear to Kveldulfer, Ltd., in Iceland. The back-pressure turbine will take steam at 385 lb/sq in and 610 deg F and exhaust at 80 lb/sq in for processing herring oil. It will be geared to a three-phase alternator of 1,250 kW at 6,000 V, stepped down to 220 V for distribution within the fish factory. A number of axial-flow machines are going to sugar mills abroad, several small Ljungstrom sets to cement works in India and Africa, while a 30,000 kW turbo-alternator is in hand for Warrington and the second 20,000 kW set has been delivered to Lincoln.



Part of a Brush 46-panel draw-out vertical switchboard for an oil derivatives concern

Similar alternators to those of 1,000 kW at 6,000 V made for the North of Scotland Hydro-Electric Board have been delivered to Syria and Iceland; also generating sets for electrolytic purposes in India. Over a thousand 50 kW alternators were dispatched during the year to Russia.

In addition to home deliveries, large transformers have gone to South Africa and to a Swedish paper mill, smaller units to the Bombay Electricity & Tramways Co., and a range of 5 kVA pole mounting types to Eire, while an order has been secured from Southern Rhodesia.

Goods dispatched included much fuse-switchgear of high rupturing capacity; control panels for diesel-alternator sets figured prominently. A 46-panel low voltage board made for Petrocarbon, Ltd., is electrically controlled from a distant desk. A new range of flameproof motors has been developed.

Small units for high voltages are a speciality of **Gresham Transformers, Ltd.,** to which contracts were recently awarded for 153 power distribution transformers for the 22 and 11 kV systems of the State Electricity Commission, Queensland, while 200 have been ordered for the 11.5 kV distribution network of the Electricity Supply Commission, Capetown.

Technical and Scientific Register

SIR ARTHUR FLEMING presided at a recent meeting of the Electrical Engineering Advisory Committee of the Technical and Scientific Register, York House, Kingsway, London, W.C.2. Those present included Sir Stanley Angwin, Mr. W. K. Brasher, Mr. E. S. Byng, Sir John Kennedy, Mr. E. A. Mills and Mr. H. T. Young.

The Committee recorded its regret at the loss sustained by the death of Sir Clifford Paterson, who had been a member since the inception of the Committee.

The progress report of the Electrical Engineering Section of the Register was considered, and amongst other matters discussed was the importance of giving advice to graduates entering the profession.

COMMERCE and INDUSTRY

Industrial Building Conference: Electrical Employment

THE Royal Institute of British Architects has organized, together with the Federation of British Industries and the T.U.C., a Conference on Industrial Building, to enable industrialists to discuss with architects the problems of factory planning and construction.

The Conference, which will be held on 3rd and 4th March, will take place at the R.I.B.A., 66, Portland Place, London, W.1. It will be divided into four sessions. Sir Percy Thomas, past president of the R.I.B.A., will preside at the first session, which will deal with large- and small-scale industry under private enterprise. The second session will cover nationalized industries, and the chairman will be Lord Citrine. At the third session the Conference will be divided into groups to enable industrialists and architects to discuss in detail electrical aspects connected with industrial building, under the following headings:—structural technique; heating and ventilating; natural and artificial lighting; various other factors affecting working conditions. A specialist will give a short paper at each group meeting. At the final session (chairman, Mr. M. Waterhouse, president, R.I.B.A.) reports will be received from the groups at the third session.

No fee will be charged, but admission to the Conference will be by ticket only, and those wishing to attend should apply to the secretary of the R.I.B.A.

Reyrolle Enquiry

Under the Order recently made by the High Court under Section 165 (a) (ii) of the 1948 Companies Act, the Board of Trade has appointed Sir Douglas Thornbury Garrett (Parker, Garrett & Co.), St. Michael's Rectory, Cornhill, London, E.C.3, to investigate the affairs of A. Reyrolle & Co., Ltd.

At the hearing of the application for an order of investigation, made by the Equatorial Trust, Ltd., a shareholder, it was stated that the company had a good reply to allegations which had been made. Counsel for the applicants said that they were not seeking an enquiry because anything wrong had been done by the company. The complaint was on the ground of alleged misfeasance by a director.

Gas Turbine Agreement

An agreement has been concluded between W. H. Allen, Sons & Co., Ltd., of Bedford, and the Bristol Aeroplane Co., Ltd., for collaboration in the application of gas turbines for marine auxiliary purposes and in the industrial field, and for the exchange of information on aeronautical and industrial turbine problems.

Store Lighting

The Leeds Industrial Co-operative Society has installed "Metrovick" fluorescent lighting in its store in the centre of the city. Some idea of the size of the store is gained from the fact that twenty-eight passenger and freight lifts are in constant use and form the bulk of the maximum demand

"Metrovick" lighting in the Leeds Industrial Co-operative Society's stores.

of 426.8 kVA. In the Furnishing Department semi-indirect fittings of a rather ornate decorative type have been replaced by "Metrovick" two-lamp V-channel fittings providing an average illumination of 13/14 lumens per sq ft as against 4 lumens per sq ft with the old fittings. With the old installation for the four floors of this department the maximum demand was 29.8 kW. This has been reduced to 17.06 kW with fluorescent lighting.

Monopolies and Restrictive Practices

The President of the Board of Trade has appointed the members of the Monopolies and Restrictive Practices Commission, the chairman of which is Sir Archibald Carter. The Commission is set up under the Monopolies and Restrictive Prac-

tices (Enquiry and Control) Act, 1948. It will not initiate enquiries but will investigate matters referred to it by the Board of Trade under the Act. Any correspondence should be addressed for the time being to the assistant secretary, I.M.1 Division, Board of Trade, Millbank, S.W.1.

Cookers for Australia

What the makers believe to be the largest individual consignment of electric cookers ever exported from this country left London for Australia last week in the *Palana*. This is part of a large order consisting of 1,360 G.E.C. domestic cookers, the bulk of which are bound for Sydney and Melbourne. They have been constructed to comply with the requirements of the Standards Association of Australia, which involved considerable modification to the standard home model. Of these cookers, 485 made the journey from the company's cooker works at Swinton, Yorkshire, to London in a special train of twenty-three wagons. To mark the occasion, several members of the G.E.C. Cooker and Transport Departments visited Victoria Docks to watch the loading and were entertained to lunch by the P. & O. on board the s.s. *Chitral*.

Part of a consignment of 1,360 G E C. cookers bound for Australia being loaded on to the "Palana"

Edinburgh Guide

The Edinburgh Corporation has published a booklet giving information to visitors spending a holiday in the city, providing a list of hotels, boarding houses, and apartments available. Particulars are also given of the Corporation transport services, and of principal attractions which the city has to offer. Copies of the booklet, "Where to Stay when in Edinburgh," can be obtained from "Apartments Booklet," Transport Offices, 2, St. James' Square, Edinburgh, 1.

Metro-Cutanit, Ltd.

The Warrington works of the Metropolitan-Vickers Electrical Co., Ltd., has been engaged in the manufacture of sintered carbides under an agreement by which the whole of the output was sold to Cutanit, Ltd. A new company has now been registered under the name of Metro-Cutanit, Ltd., to take over, as from 1st January, and combine the production of the Warrington works with the technical and commercial activities at present carried out by Cutanit, Ltd., and by Compound Electro-Metals, Ltd. The registration of Metro-Cutanit, Ltd., is recorded in our "New Companies" section.

Metropolitan-Vickers has a substantial interest in Metro-Cutanit, Ltd., and the board of the new company consists of an equal number of directors appointed by Metropolitan-Vickers and Cutanit respectively. Mr. I. R. Cox, managing director of Metropolitan-Vickers, is chairman of the new company, which will commence operations with a large and active interest in the production and sale, under the registered trade mark, "Cutanit," of metallic carbides of all kinds for use in cutting tools, drawing dies, wear-resisting parts, etc. Another branch of the business will be the production and sale, under the trade mark "Elmet," of compound metals for use in switchgear, resistance welding equipments, bearings, etc.

The main distributors for the carbide products of the new company are Wm. Jessop & Sons, Ltd., of Sheffield.

Survey of Industrial Management

The British Institute of Management has published the first of a series of publications as a contribution to the field of management literature. The paper is entitled "A Short Survey of Industrial Management," by L. Urwick, and like the succeeding papers expresses the personal opinion of the author and does not necessarily represent the official views of the Institute. The survey contains sections on the nature of management and the evolution, mechanics and dynamics of management. There is a concluding section entitled "Looking Forward."

In this brief survey the author emphasizes the enormous amount of work still to be done and expresses the hope that more attention will be paid to management principles in Great Britain in the future. Copies of the publication can be obtained from the Institute, 17, Hill Street, London, W.1, price 2s 6d.

London Transport Battery Locomotives

Seven sets of control equipment and batteries are being supplied to the London Transport Executive by the General Electric Co., Ltd., for use in new battery locomotives for hauling trains equipped for maintenance and construction work (including cable-laying) on the London Transport system. Nine locomotives of this type are in service already, six being provided with G.E.C. electrical equipment. A feature of the control equipment is the provision of twenty-eight notches and three combinations of the four motors (series, series-parallel and parallel) with one controller handle. Control is carried out by electro-pneumatic contactors, and the large number of notches is necessitated by the low speed operation with varying loads involved in the duties these locomotives are required to perform. The batteries are used for traction when power is not available, but the motors can be supplied from the conductor rails. Provision is made for charging the batteries from the conductor rails.

Industrial Finishes Exhibition

In connection with the Industrial Finishes Exhibition—the first of its kind to be presented in Great Britain—to be held at Earls Court, London, from 31st August to 13th September, an Honorary Advisory Council is now being formed. Among those who will serve on this council are Lord Lucas of Chilworth; Sir Edward Appleton, Director of Scientific and Industrial Research; Mr. G. L. Bailey, British Non-Ferrous Metals Research Association; Dr. W. B. de B. Diamond, general manager, British Plastics Federation; Col. H. A. P. Disney, director, British Export Trade Research Organisation; Mr. Leslie Gamage, General Electric Co., Ltd.; Mr. Leslie Hardern, chairman, Design and Industries Association; Mr. G. W. Preston, Copper Development Association; and Dr. E. G. West, technical director, Aluminium Development Association. An Advisory Technical Committee is already assisting the promoters of the exhibition (whose address is 26, Old Brompton Road, S.W.7).

One of the aims of the exhibition will be to demonstrate to the foreign buyer that the British manufacturer is "finish conscious." The exhibition will also enable industrial users of finishes, as well as people engaged in distribution and the general public, to see for the first time under one roof the variety of finishes and processes and their comparative qualities for different uses. Several new finishes will be demonstrated.

Electrical Production

During the third quarter of last year 555,700 kW of steam turbo-alternators rated at 10,000 kW or over was produced by British manufacturers. Of the total, 137,200 kW was for export. The production of steam turbines of less than 10,000 kW amounted to 49,200 kW (37,200 kW for export), and of hydraulic turbines 40,000 b.h.p. (9,600 b.h.p. for export). Rotating electrical machinery (including generators and motors) of from 1 to 250 h.p., kW or kVA was produced to the value of £4,873,000, of which £984,000 represented production for export. Fractional h.p. machines to the value of £1,783,000 were produced, including £364,000 for export.

The value of insulated wire and cable produced during the quarter is given as £5,637,000 (export £2,048,000), and of accumulators £3,402,000 (export £1,034,000).

Cables Flown to Germany.

A rush order for 500 yd of four-core 60 V paper-insulated cable, for use at an R.A.F. station in Germany, was recently carried out at the South Wales works of Aberdare Cables, Ltd. On completion of the order two drums, each carrying 250 yd of cable and weighing 57 cwt were rushed to an airfield in the south of England for conveyance to Germany.

Electrical Employment

The December *Ministry of Labour Gazette* shows that the number of insured workers employed in the electrical engineering industry last October was 162,200, compared with 162,400 in September. In electrical wiring and contracting there were 63,700 (same), and in the manufacture of electrical apparatus, cables, lamps, etc., 271,800 (268,900).

At 15th November unemployed persons in the electrical industry in Great Britain were as follows (figures for 11th October in parentheses): Machinery 1,491 (1,549); wires and cables 701 (757); telegraph and telephone apparatus 332 (373); radio apparatus (excluding valves) and gramophones 948 (1,110); radio valves and electric lamps 247 (299); batteries and accumulators 270 (248); other electrical goods 1,564 (1,693); wiring and contracting 1,252 (1,499); electricity supply 775 (698).

During the four weeks ended 27th October

the numbers of persons placed in employment in undermanned industries, with comparisons for the preceding four weeks, included the following: production of generating plant for electricity undertakings 684 (569); power station construction 775 (807); and Scottish hydro-electric schemes 1,249 (1,284).

Lowestoft Cooker Contract

In our issue of 24th December we reported that the Lowestoft Corporation had placed an order with the Piggott Electrical Co., Ltd., for the installation of electric cookers and wash-boilers. The company point out that they are wholesalers and are only supplying the appliances—not installing them. The error is regretted.

Reports on German Industry

In order to make all the technical information on Germany available to British industry the Technical Information and Documents Unit is now making summaries of those reports which were not considered to have sufficiently wide interest to warrant the expense of printing or which were unsuitable for printing. The reports may be seen at the Technical Information and Documents Unit, 40, Cadogan Square, S.W.1, and photo-copies can be made at cost on request. It will also be possible to borrow copies of these reports for a short time. They will be listed in the *Board of Trade Journal* periodically under F.D. reference numbers.

The following new reports on German industry are now published, and may be seen at the principal public libraries, etc., or may be purchased at H.M. Stationery Office:—BIOS.1730, "Industrial Electrical Research in Germany" (17s 10d post free); BIOS.1751, "German Research on Semi-Conductors, Metal Rectifiers, Detectors and Photocells" (5s 8d); BIOS/MISC.111, "Dutch Report on German Accumulator Factories" (2s 1d).

Trade Announcements

Mr. R. Sanders, of 45, Roxborough Park, Harrow, Middx., has now joined the sales staff of **Taylor Electrical Instruments, Ltd.,** covering the North London postal districts and the county of Middlesex.

Newey & Eyre, Ltd., electrical wholesalers, are opening a new branch at 243, Horn Lane, Acton, London, W.3, on 24th January.

Catalogues and Lists

Courtney, Pope (Electrical), Ltd., Amhurst Park Works, Tottenham, London, N.15.—Catalogue of "Amhurst" fluorescent lighting fittings.

Bulpitt & Sons, Ltd., Swansea Works, Birmingham, 1.—Folder on "Swan" automatically controlled smoothing irons.

Metway Electrical Industries, Ltd., King Street, Brighton, 1, Sussex.—Priced catalogue of wiring accessories.

Bescol (Electric), Ltd., Parkfield Road, Saltley, Birmingham, 8.—Priced catalogue of electric kettles, space heaters, tubular heaters and fires.

Evershed & Vignoles, Ltd., Chiswick, London, W.4.—Technical folder on the "Megger" insulation tester series 1.

Hanovia, Ltd., Slough, Bucks.—Priced leaflet on the "Sollux" infra-red lamp (model H.VI).

Spencer Coates & Co., Ltd., Bush Lane House, Cannon Street, London, E.C.4.—Leaflet illustrating an inter-office relay system.

Rich & Pattison (Birmingham), Ltd., 79-81, Jamaica Row, Birmingham, 5.—Illustrated loose-leaf catalogue of electrical appliances and accessories.

Singleton Bros. (Instruments), Ltd., 53, Victoria Street, London, S.W.1.—Leaflet on the "Surran" vehicle engine warmer.

Ward & Goldstone, Ltd., Pendleton, Manchester, 6.—Priced folder on an a.c. mains operated bell.

Mercury Discharge Lighting Co., Ltd., Mercury House, 186, Seven Sisters Road, London, N.7.—Priced leaflet on a fluorescent desk lamp.

The Industrial Electrical Co., Ltd., Offord Street Works, Offord Road, London, N.1.—Priced stock list of new and reconditioned electric motors, etc.

J. G. Statter & Co., Ltd., 82, Victoria Street, London, S.W.1.—Technical leaflet (No. 218) illustrating the type "MA" metalclad oil-immersed circuit breaker for up to 100 A at 600 V.

Rowlands Electrical Accessories, Ltd., R.E.A.L. Works, Hockley Hill, Birmingham, 18.—Priced folder on vitreous enammelled reflectors and flameproof lighting fittings.

Morphy-Richards, Ltd., St. Mary Cray, Kent.—Priced leaflet illustrating a safety stand for smoothing irons.

E.I.B.A. (Birmingham)

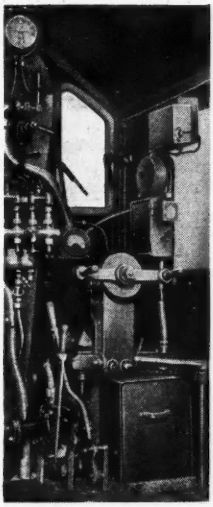
THE Birmingham & District Branch of the Electrical Industries Benevolent Association is holding a dance at the T.I. Social Club, Oldbury, near Birmingham, on 11th Feb. Tickets (10s each, exclusive of buffet) may be obtained from Mr. L. Wall, hon. secy., E.I.B.A., c/o Electrical Components, Ltd., 102, Snow Hill, Birmingham, 4.

Automatic Train Control

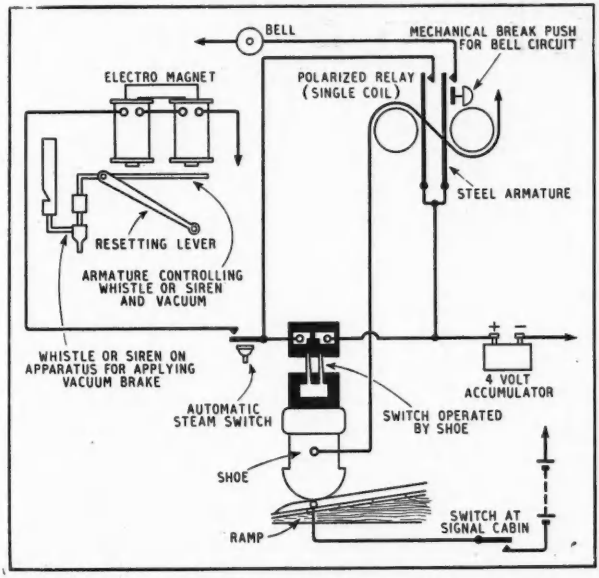
Former and Present Methods

By H. C. TOWERS*
M.I.E.E., M.I.R.S.E.
M.Inst.T.

THE automatic control of trains operates in conjunction with fixed signals so that if a driver passes a danger signal a warning is given in the engine cabin and the brakes are applied. The possibility of an imperfect or false "clear" indication is now negligible, but serious accidents have occurred through drivers missing danger signals. The large boiler of the modern steam engine, by narrowing the driver's view, adds a difficulty that is not experienced with an electric train or locomotive. In a typical disaster in 1931, the distant signal was missed in clear weather owing to the train's excessive speed. As a consequence the engine was derailed and the train wrecked.



G.W.R. system of automatic train control with apparatus in locomotive cab shown above



A Ministry of Transport officer reported: "Had equipment of this kind [automatic train control] existed, operating in conjunction with the distant signal, I think that this accident would have been prevented."

Even if faultless control were devised, fixed signals could not be dispensed with as the vigilance of drivers would tend greatly to diminish. Again, entrances to block sections must be clearly marked, and signals are also required for shunt movements and for the interlocking of points and cross-overs. The ideal system combines fixed signals with a warning and perhaps automatic brake application.

Inventions were patented in 1840 which claimed to stop trains if they passed signals. In one of these a pointsman working a lever caused an arm to strike a moving member on the engine which operated both steam regulator and whistle. In another a ramp was worked by a wire in conjunction with the signal; a vertical

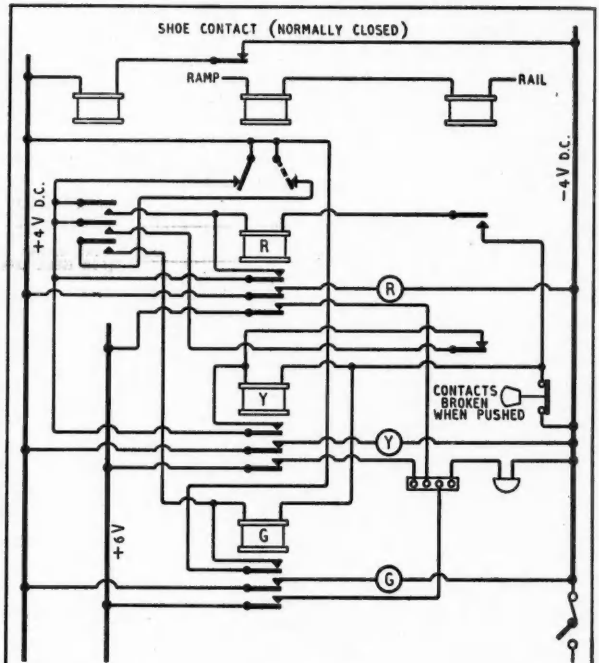
** Deputy Chief Engineer (Signals), Bombay, Baroda and Central India Railway.*

rod attached to the tender axle box had a roller at the bottom end to minimize friction with the ramp, which operated red, white and green glasses. In an invention introduced on the French Nord in 1872 a brush on the engine collected current when a danger signal was passed and operated an electro-magnet controlling a steam whistle.

The chief disadvantage of all these systems even now is the number of moving parts involved. The delicate apparatus often suggested would also be unsuitable for use under footplate conditions. However, an installation on the former Great Western Railway has been in use since 1906, devised by three G.W.R. officials, Jacobs, Insell and Bowden. To understand it, reference must be made to the function of the distant signal, the first encountered when approaching a station, which when at "caution" warns the driver that the next or next-but-one stop signal is at danger. The usual interval between a distant signal and the first stop signal is 880 to 1,000 yd.

In the G.W.R. system a metal ramp 40 to 60 ft long in the middle of the track is electrically connected to the distant-signal lever and energized when the signal is off. A contact shoe on the engine controls normal contacts, while a local circuit controls a relay governing the steam whistle and vacuum brake. If the engine passes over a de-energized ramp (distant signal at "caution"), the shoe, raised on meeting the ramp, breaks its contacts and drops the controlling relay. The whistle is sounded and the brakes are applied. If, however, the ramp is energized, the circuit goes through a polarized relay which rings an electric bell on the engine and also prevents the controlling relay from dropping. Thousands of miles of G.W.R. main-line track are equipped with this apparatus, which works well under strenuous conditions.

The Hudd system now installed on sections (principally the London-South-end) of the former London, Midland and Scottish Railway does not use any moving apparatus on the locomotive. Two inductors are placed between the running rails, 20 yd apart and 200 yd outside the distant signal. One is a permanent magnet with the *south* pole facing the oncoming traffic; the other is an electro-magnet which at 12V produces a powerful magnetic field, its *north* pole being directed towards oncoming traffic.



Locomotive circuit for B.B. & C.I. Railway experimental automatic train control

This inductor is energized when the distant signal is off through a local circuit controlled by a line relay operated from the cabin. The engine's receiving unit consists of an iron collecting plate with pole pieces, the plate passing over the inductors with a 4 in clearance. A permanent-magnet armature between the pole pieces, mounted on ball bearings, is connected to the engine's vacuum apparatus, and on passing over the permanent-magnet inductor is partially rotated, sounding the vacuum horn. If the second inductor is energized, the armature is restored to its original position and the horn closed, but, if not, the horn continues to sound and the brakes are applied.

In 1946 an Automatic Train Control Committee for all India was set up in Bombay, its chairman being the general manager of the Bombay, Baroda and Central India Railway and its members the chief signal engineers of that railway and the Great Indian Peninsular Railway and the chief transportation officer. This committee is experimenting with the Hudd apparatus at ten stations on the B.B. and C.I. Railway and with the American (General Railway Signal Co.) inductive system on the G.I.P. Railway. The B.B. and C.I. Railway is also trying out an adaptation of the Great Western system. Because of clearance difficulties, the ramp is mounted outside the rails and the collecting shoe is attached to the non-spring-borne part of the tender. The ramp is positively, or negatively, energized, or remains unenergized, according to the signal aspect. Circuits operated on the locomotive sound a bell and illuminate a red, yellow or green aspect. The final form of the apparatus has not yet been decided.

Safety in Schools

ONE chapter of the recently issued Pamphlet No. 13, "Safety Precautions in Schools," of the Ministry of Education (H.M. Stationery Office, 9d) deals with precautions in the use of electricity. In the introduction it is stated that a study of the properties of electric currents is now included in the science courses of most schools, and electrical appliances are used for many purposes. This is approved and although, it is said, accidents are rare, even with badly protected circuits, a false sense of security causes laxity which may lead to serious accidents.

It is considered necessary first to understand something of the nature of electric shock. A brief study of effects is given and the importance of immediate artificial respiration is stressed. Mention is made of the instructions for treatment obtainable from the technical Press which should be prominently displayed. Next, the chapter touches upon voltages, earth-free rooms, types and proper installation of switches and earth connections.

Electrical equipment in schools consists first of the permanent installations for lighting, heating, cooking and power. These, it is pointed out, should be designed and approved by a qualified electrical engineer, and should not be extended or modified without reference. Compliance with the I.E.E. Regulations should be a condition of contract. Suggestions are made to secure safety in installation and operation.

Next the laboratory apparatus used by younger children is considered. The use of low voltage (12 or 14V) is recommended with transformers securely protected against interference. Protection of circuits is outlined. For d.c. the use of accumulator batteries is suggested. Apparatus used by teachers and senior pupils will probably need to be operated at higher voltages, in which case a 110-V transformer with the central point of the secondary earthed may be used. Where high-voltages are necessary, as with X-ray and cathode-ray tubes, the use of the power pack with short-circuit current limitation is recommended. Again, installation by a qualified person is emphasized. As regards portable equipment—optical projectors, drills, soldering irons, smoothing irons, kettles, immersion heaters, etc.—stress is laid on the importance of the proper provision and maintenance of earth connections.

Connections are dealt with in a separate paragraph. There is a warning against use of long trailing leads, twisted joints and unprotected terminals. The advantages of interlocked switch plugs are pointed out.

Electrical Commercial Travellers

A general meeting of the Electrical Trades' Commercial Travellers' Association is being held to-day (Friday) at the Feathers Hotel, London, S.W.1.

The annual luncheon of the Association will take place on 18th February at the Connaught Rooms, Great Queen Street, W.C.2.

FINANCIAL SECTION

Company News
Stock Exchange Activities

Reports and Dividends

The Perak River Hydro-Electric Power Co., Ltd.—Speaking at the annual meeting held on 30th December, Mr. W. Shearer (chairman) said that the year under review was a period of satisfactory trading with a steady rehabilitation of the company's assets. The peak load rose from 29,200 kW to 38,200 kW, which compared with 50,000 kW during 1941, when the system was working to full capacity. At Malim Nawar steam power station two 6,000 kW sets and one 12,000 kW set had been overhauled and were ready for continuous service. The turbine rotor of the third 6,000 kW set, which was damaged during the Japanese occupation and returned to England for adjustment, was expected to be ready for shipment shortly. At Batu Gajah steam station the turbine of the 12,000 kW set, which the Japanese had transferred to Singapore, had been reinstated and, pending the delivery of a new rotor, could safely be used to the extent of a load of 8,000 kW. Both 3,000 kW sets were ready for service. Rehabilitation of the distribution system continued throughout the year. Electricity generated during the year totalled 238 million kWh, an increase of 88 per cent as compared with the previous year, but of this output 35 million kWh were generated by steam stations entailing a considerable increase in costs. The plant was not fully loaded; there was a total of 68,000 h.p. connected, compared with 88,000 h.p. in 1941. In addition they had definite commitments for the whole of that portion of their capacity not yet operating, and for some time past they had not been able to accept further demands for short-term mining supply.

Broadcast Relay Service, Ltd.—The directors have announced plans for raising additional finance. Although the company's licence from the Postmaster-General can be terminated after 31st December, 1949, the directors state that they have no reason to believe that any such termination is contemplated. In these circumstances, however, it is considered inadvisable to raise the required capital by an immedate issue of ordinary shares. Subject to Treasury consent it had been proposed to make an issue to ordinary stockholders of £2,000,000 3½ per cent convertible debenture stock for later conversion into ordinary shares. Treasury consent now received limits the issue to £750,000 for cash at par to ordinary stockholders. As an instrument in the further financing of the business, a new subsidiary, Rediffusion Holdings, has been formed to which Broadcast Relay Services will transfer substantially the whole of its assets, including the balance of £544,000 from the issue to ordinary stockholders. This balance will remain after £206,000 has been applied to the reduction of bank overdraft. The assets to be transferred to Rediffusion Holdings for £7,000,000 are certified to have cost the company £5,680,621. A 25 per cent interest in the new company has been sold to British Electric Traction for £1,750,000 with an option to convert into ordinary shares, at a price of 22s per 5s share, equivalent to a total of 1,590,909 shares.

Radio Rentals, Ltd., reports a trading profit for the year ended 31st August last of £109,619, and after deducting income tax and profits tax, a net profit of £89,244, as compared with £51,355 for the preceding year, to which is added £67,204 brought in, sundry reserves no longer required £2,300, and taxation provision no longer required, £26,450, making £185,198 available. It is proposed to transfer £42,500 to tax equalization account and £45,000 to reserves. As already announced, the proposed final ordinary dividend is 17½ per cent, maintaining the distribution at 25 per cent for the year, and the balance carried forward is £77,481. The consolidated trading profit for the year is £323,382, and the net profit £115,454.

In his statement, which accompanies the report and accounts, Mr. H. F. Hunt (chairman) says that during the year under review over half a million pounds has been spent on new radio receivers.

The Brush Electrical Engineering Co., Ltd.—At the adjourned meeting of the ordinary and preference stockholders held on 7th January, resolutions were passed approving the acquisition by the Brush Co., of Mirrlees, Bickerton & Day and J. & H. McLaren, subsidiaries of Associated British Engineering, Ltd. Stockholders of Associated British Engineering approved the resolutions at their meetings held the previous week.

Marco Refrigerators, Ltd.—In order to repay a bank overdraft of £75,548 raised for the purchase of an additional factory and adjoining land and to provide additional working capital, Marco Refrigerators, Ltd., is issuing to its brokers the recently created £100,000 5½ per cent cumulative redeemable preference £1 shares at par, who will place them privately at 21s free of stamp. Dealings were expected to start yesterday (Thursday).

Scophony, Ltd.—An extraordinary meeting will be held on 2nd February, when

resolutions will be submitted proposing that the name of the company be changed to Scophony-Baird, Ltd.

Greenwood & Batley, Ltd., have declared an unchanged interim dividend of 5 per cent.

New Companies

Metro-Cutanit, Ltd.—Regd. 31st Dec. Capital £98,000: to enter into agreements with Associated Electrical Industries, Ltd., and Cutanit, Ltd., to carry on, develop and turn to account the property and assets to be acquired under such agreements, and to carry on the business of chemical, mechanical, electrical, automobile, aeronautical, hydraulic, photographic, marine and civil engineers, etc. Solicitors E. F. Turner & Son, E.C.3. Regd. office: 42, Pall Mall, S.W.1.

James F. Ryder, Ltd.—Registered in Dublin, 20th December. Capital £5,000. To acquire the business of an electrical contractor, etc., carried on by J. F. Ryder, as James F. Ryder & Son. J. F. Ryder, 12, Manor Street, Dublin, is governing director.

W. G. Haywood & Co., Ltd.—Registered 21st December. Capital £500. To acquire the business of manufacturing electrical engineers, general engineers and founders carried on by A. H. Brackensey and V. H. Frank at 20, 31 and 32, Seaton Place, Euston Road, N.W.1, as W. G. Haywood & Co. Directors: E. A. Baker and V. H. Frank. Regd. office: 30, Seaton Place, N.W.1.

E. Chidlow & Co., Ltd.—Registered 24 December. Capital £2,000: to acquire the business of engineering designers and electrical engineers and contractors carried on at Shrewsbury as Engineering Design Co. Directors: E. Chidlow, J. Thomas, and W. Wright. Regd. office: 10, Pride Hill Chambers, Shrewsbury.

Potts & Son (Electrical Contractors), Ltd.—Regd. 1st Jan. Capital £3,000: to acquire the business of electrical contractors and wireless and electrical dealers carried on by W. J. Potts, trading as Potts & Son at 14, Commerce Street, Longton, Stoke-on-Trent. W. J. Potts is first and permanent director. Regd. office: 14, Commerce Street, Longton, Stoke-on-Trent.

Fidelity Instrument Co., Ltd.—Regd. 30th Dec. Capital £20,000. Makers of scientific, optical, electronic and other precision instruments and apparatus, etc. Directors: F. A. Landucci and F. K. Crowther. Regd. office: 284, Western Road, S.W.19.

W. Shipp & Son, Ltd.—Regd. 29th Dec. Capital £2,500: to acquire the business of electrical engineers and contractors formerly carried on by the late W. H. Shipp at 4, Union Street, Borough, as W. Shipp & Son. Directors: Mrs. M. R. Shipp, S. Woodward and W. F. Ellisdon. Regd. office: 2/4, Union Street, Borough, S.E.

Wright, Partners, Ltd.—Regd. 3rd Jan. Capital £1,000. Electrical specialists, suppliers and contractors, etc. Directors: H. Adams (managing director) and T. B. Warnaby. Regd office: 27, Lowthian Road, West Hartlepool.

W. G. Hodges, Ltd.—Regd. 1st Jan. Capital £4,000: to acquire the business of an electrical and radio engineer carried on by W. G. Hodges at 337a, Holdenhurst Road, Bournemouth. W. G. Hodges is first and permanent director, Regd. office: Waterloo Chambers, Fir Vale Road, Bournemouth.

E. Clarke (Electrical), Ltd.—Regd. 30th Dec. Capital £5,000. Electrical wholesalers, etc. Directors: W. I. Jones and W. E. Watkinson. Regd. office: 63, Ansdell Road, Blackpool.

R.A.E. (St. Austell), Ltd.—Regd. 31st Dec. Capital £1,000. Electrical engineers and contractors, manufacturers of and dealers in dynamos, motors, armatures, magnetos, etc. Directors: D. L. Gollop (managing director), K. A. Payne and F. L. Jenkin. Regd. office: 20, Fore Street, St. Austell, Cornwall.

L. J. Palmer of London, Ltd.—Regd. 1st Jan. Capital £1,000. Electrical engineers and contractors, electricians, radio engineers, etc. Subscribers: L. J. Palmer and A. E. S. Padden. Regd. office: 190, Halfway Street, Sidcup.

Liquidations

Charlton Electrical Appliances, Ltd.—Winding-up voluntarily. Liquidators, Mr. R. A. Haigh, Court Chambers, Friar Lane, Leicester, and Mr. P. T. Muggison, 33, Friar Lane, Leicester. Particulars of claims to the liquidators by 16th February.

Bankruptcies

J. A. Woolcock, residing at "Bramar," Marine Drive, Greatstone, Kent, lately of Seven Starrs, High Street, Robertsbridge, Sussex, wireless and electrical engineer, and lately carrying on business and residing at Iridge Cottage, Hurst Green, Sussex, and also at John Cross, Mountfield, Robertsbridge.—Trustee, Mr. A. E. Orbell, 6 and 7, Old Steine, Brighton, released 17th December, 1948.

L. Dean, Hazebrook Camp, Arborfield, Reading, and lately residing at 2, Saxon Mansions, Grand Parade, St. Leonards-on-Sea, electrical engineer.—First meeting 17th January at 20, Eaton Place, London, S.W.1. Public examination 10th February, at the Assize Court, Reading.

STOCKS and SHARES

IF it cannot be said that January has brought, so far, a great deal of fresh business into the Stock Exchange markets, it can at least be recorded that prices by their firmness indicate the presence of the investor and the readiness of capital to absorb stock of good class which comes on offer. The gilt-edged market once more leads the way. Money is flowing into British Transport Threes and British Electricity Threes, both of these stocks being a little relatively cheaper than Consols. The two prices have advanced during the past week to 100⅝ and 103 1/16 respectively, and the tendency of the market as a whole seems to be upward, with an occasional note of hesitation when developments on the Continent are particularly disturbing.

Radio Activity

E. K. Cole 5s ordinary have been a good market in advance of the final dividend. At 16s 6d they are 1s to the good as compared with the price a week ago. The yield on last year's payment of 22½ per cent is over 6¾ per cent, but this year's interim was reduced from 8 to 6 per cent. The 7 per cent participating preferred, which have lately been receiving their maximum of 3 per cent extra, are 26s 3d. E.M.I. remain active around the guinea mark, but Deccas at 22s have been dull since the placing of notes reported a fortnight ago. Cossors are unchanged at 11s.

Broadcast Relay Debentures

New 3½ per cent debentures to be offered at par to ordinary stockholders of Broadcast Relay Services will carry the interesting option to convert the stock into 5s ordinary shares, until 1952, at the rate of one share for each 26s nominal of debentures. Present price of the shares is 23s 6d., at which they show a yield equivalent to 5½ per cent gross, on the last year's conservative dividend of 13 per cent tax free. The price would probably be regarded as an undervaluation but for the Postmaster-General's power to terminate the licences after the end of this year. According to last week's statement, the company has no reason to believe that termination is contemplated, but stockholders will hope for an early official decision.

B.E.T.'s Interest

British Electric Traction is underwriting Broadcast Relay's new debenture issue, and increasing its already substantial stake in the business by taking a 25 per cent interest in Rediffusion Holdings. This subsidiary has been formed to take over Broadcast Relay's assets, and constitutes one stage in the further financing of that company's business. B.E.T. is paying £1¾ million for the interest, which carries conversion rights into Broadcast Relay shares at 22s. Interest in B.E.T. deferred stock continues to be animated, to a large extent, by the example of the Tillings deal. It also follows attentively the new shoots which appear in succession from the older branches of Mr. Drayton's group.

Hackbridge Cable Holdings

This company's 5s ordinary shares are showing signs of movement, after hanging fire for some time about the price of 15s 6d, at which they were offered for sale last September. Having risen this week to 16s 3d, they still show a prospective yield of £6 3s per cent. The first accounts will cover a period of about six months to the end of next March. Last year's profits represented earnings of 39 per cent on the £450,000 ordinary capital. Assuming that profits continue at not less than this level, the intention is to pay a dividend at the rate of 20 per cent per annum for the broken period. In front of the ordinary is an equal amount of 5 per cent preference shares, which stand at 24s 9d.

The Week's Price Changes

British Electric Traction deferred shows the principal change on the week with a decline of 30 points to 1945, but perhaps of more general interest is the rise of 3 in Cable & Wireless ordinary to 221, after touching 224. The arbitration begins this week. A sympathetic rise of 2s 9d in Globe Telegraph & Trust ordinary lifted the price to 51s 3d. Metal Industries at 49s are up a shilling. Siemens at 36s are 6d higher. C. A. Parsons rose 1s 9d to 63s 9d. On the other hand, Hoover at 36s 3d are 1/8 lower and British Vacuum Cleaner at 13s have gone back a trifle. Crabtrees eased off to two guineas.

Miscellaneous Matters

Aberdare Cables new ordinary shares are still available—until 21st of this month—in the form of renounced allotment letters, and, consequently, free of the expensive 2 per cent transfer stamp on a purchase. At 67s 3d, they yield £4 9s 3d per cent. A similar return can be obtained from Revo Electric 10s shares, of which a line is on offer at 61s 6d. Reyrolles can be bought at 61s 9d, and English Electric at 49s 3d, both paying £4 1s 3d per cent on the money. Prices for Automatic Telephone ordinary and the "B" deferred have come into line at 64s 3d, at which the return works out to £3 17s 9d per cent.

Electricity Supply

Opposition to Power Station Projects

Barnard Castle.—RURAL EXTENSIONS.—The Rural District Council has been informed by the North Eastern Electricity Board that the reason for the delay in supplying electricity to Stainton is that all consents for pole erection have not yet been received. After the receipt of the final consent, the line could be erected within six months.

Burton-on-Trent.—FLOOD WATER CAUSES BREAKDOWN.—Flood water of the river Trent at Meadow Road, Burton-on-Trent, caused an explosion in an 11 kV cable junction box on Monday last week and the whole of South Derbyshire was without electricity for half an hour.

Doncaster.—ESTATE LIGHTING.—The Corporation has approved a scheme submitted by the borough surveyor for lighting streets on the Intake housing estate at an estimated cost of £2,353.

Enfield.—ARTERIAL ROAD LIGHTING.—A special sub-committee is to view the lighting on a section of the Barnet By-Pass near Hatfield, and subject to a satisfactory report the engineer is to seek the approval of the Minister of Transport to a proposed scheme for the re-illumination of Great Cambridge Road by electricity at an estimated cost of £12,000.

Grantham.—STREET LIGHTING CONVERSION.—A scheme is under consideration for conversion of all the town's street lighting from gas to electricity.

Hornsey.—STREET LIGHTING IMPROVEMENTS.—The Borough Council is recommended to approve a scheme estimated to cost £4,500 for improvements to the street lighting at Archway Road and Aylmer Road.

Liverpool. — LARGE SURPLUS. — The accounts of the former electricity undertaking for the year to 31st March last were submitted to the City Council on 5th January. On distribution revenue account there was a gross surplus of £629,367, compared with £652,925 the previous year. The income from sales was £3,405,724 (an increase of £95,063). The net profit of the undertaking was £249,453.

Manchester.—DISTRICT HEATING.—The Housing Committee has given authority (so far as it is concerned) for the services of an electrical consultant to be retained, if considered advisable, in connection with negotiations with the B.E.A. regarding the Wythenshawe district heating scheme.

Northampton.—POWER STATION and AMENITIES.—The Corporation Town Planning Committee is recommending the County Council not to grant planning permission for the erection of power station buildings at Hardingstone by the British Electricity Authority. It is emphasized that there is a considerable difference in the magnitude of the present scheme as compared with that put forward by the Northampton Electric Light and Power Co. in February, 1948. A much greater area of land is now required to provide for a large coal dump, and an ultimate total of five cooling towers is envisaged. The final scheme, asserts the Committee, will undoubtedly have an adverse effect on the amenities of the town.

Orkney.—SITE FOR POWER STATION.—Kirkwall Town Council has considered an application by the North of Scotland Hydro Electric Board for a site on the Peerie Sea (Kirkwalls innermost harbour) and it has been agreed, subject to the approval of the county planning officer, that the Board should be offered space there. It is understood that the new station, which is intended to house six new 1,000 kW generators, will be the main power station for the county.

Warwickshire.—OBJECTION TO POWER SCHEME.—Contending that the project would seriously impede the district's amenities, the Leamington Town Planning Committee is joining the Warwickshire County Council and Warwick and Kenilworth Councils in protesting "in the strongest possible terms," against the East Midland Electricity Board's proposal to construct a generating station on the banks of the Avon at Hill Wootton to serve the Nuneaton and Hinckley areas. The station, it is stated, will cost £11,500,000 and will take in 259 acres of good agricultural land. The Committee stresses the inevitably adverse effects on Leamington and district occasioned by the furtherance of such a scheme, and it is pointed out that it is in direct contravention of proposals outlined in the West Midlands plan for the development of Leamington as a conference and cultural area.

Wimbledon.—NEW POWER STATION.—The Corporation understands from the British Electricity Authority that it has been decided to proceed with the erection of the proposed new power station, notwithstanding the opposition of the Borough Council, and that a compulsory purchase order is to be made for the acquisition of

land owned by the Corporation for the erection of the station. The Surrey County Council Town and Country Planning Committee is reported to have refused planning permission for the erection of the proposed cooling towers and coal storage as the first stage in the reconstruction of the station.

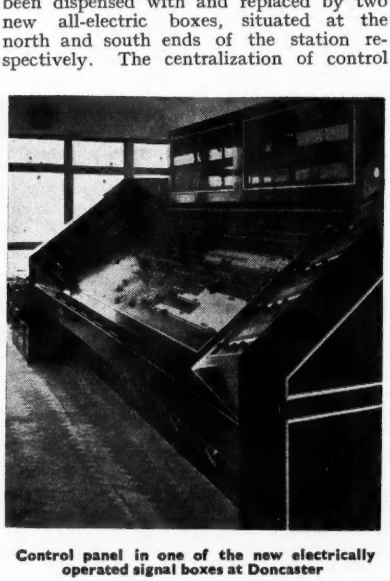
Overseas

United States.—NEW GENERATING CAPACITY.—The results of a survey of the country's electric power industry were reviewed recently by Mr. E. R. Acker, president of the Edison Electric Institute. At the end of 1946 the total generating capacity was 50,316,621 kW, and additions scheduled for the five-year period 1947-51 amount to 25,300,000 kW (including 20,900,000 kW by private companies and 4,400,000 kW by public bodies). Approximately 2,000,000 kW of new generating capacity was made available in 1947, and the 1948 addition is expected to be 4,750,000 kW. Extensions planned for 1949 amount to 6,700,000 kW; for 1950, 5,800,000 kW; and for 1951, 6,050,000 kW. Reserve generating capacity, at present 4 per cent, is expected to rise to 8 per cent next December and to reach 14 per cent—which is regarded as a normal reserve—by 1951.

Railway Signalling

NEW SYSTEM AT DONCASTER

IN connection with the remodelling of Doncaster railway station an entirely new signalling system has been installed. Six existing mechanical signal boxes have been dispensed with and replaced by two new all-electric boxes, situated at the north and south ends of the station respectively. The centralization of control thus effected will greatly improve the handling of traffic through this busy area which, besides being the junction of the main London to Leeds and York lines, has important branches to Sheffield, Hull and Grimsby.



Control panel in one of the new electrically operated signal boxes at Doncaster

As with the former L.N.E.R. practice at interlockings of this nature, the signalling is controlled from a panel operating on the route-setting principle. The panel, which shows the track layout in diagram form, carries switches located to correspond with the actual position of the signal they control. The associated interlocking equipment was designed and developed by Standard Telephones & Cables, Ltd., and, known as sequence switch interlocking, represents an economical method of eliminating as far as practicable the human factor in the setting of signals and points. This is the first installation of its kind in the world, and its operation will be keenly observed by railway signal engineers from all countries.

A signalman can, merely by turning a switch to the appropriate position and pressing it down, set the track for a train to move across any given number of intersecting lines. In an example quoted to Press representatives last week, 134 train movements take place in one three-hour period, requiring two signalmen to operate mechanical levers 1,294 times, which is equivalent to once every 8.5 seconds. With the electrical system they will now make 486 switch movements on their panels, one every 23 seconds, with almost no physical effort. The arrangement also disposes of six out of several electrical connections in the yard and box layout.

This is an extension of interlocking, by which is meant the automatic locking of the rearward signal until the train on a section has moved out of it. Thus a false "clear" indication cannot be given and the signalman is warned of failure at the signal or points if the lamp beside his switch does not react appropriately.

I.E.E. London Meetings

THE programme for the second half of the 1948-49 session of the Institution of Electrical Engineers is now published, and the London meetings are given below:—

Ordinary meetings: 3rd February: "Tidal Power and the Severn Barrage," by H. Headland. (Supply Section paper.) (Joint meeting with the Institution of Civil Engineers). 16th February: Faraday Lecture on "Television," by Sir Noel Ashbridge and H. Bishop. (At the Central Hall, Westminster.) 3rd March: "Electric and Diesel-Electric Traction on the Netherlands Railways," by H. J. van Lessen. 4th March (Friday): "Causes of Flue Gas Deposits and Corrosion in Modern Boiler Plants," by W. F. Harlow. (Joint meeting with the Institution of Mechanical Engineers at Storey's Gate, St. James's Park, S.W.1.) 31st March: "Overhead Line Regulations," by H. W. Grimmitt. (Supply Section paper). 21st April: Kelvin Lecture on "Semi-Conductors and Rectifiers," by Prof. N. F. Mott. The annual dinner will be held at the Connaught Rooms on 24th February, the annual general meeting on 12th May, and the summer meeting in Scotland from 30th May to 3rd June.

Extra meetings: 17th February: "Railway Traction Control Equipment on Suburban London Transport," by E. Webster. 17th March: "Visual Methods in Engineering Teaching," by H. E. Dance. 28th April: "The Motor Uniselector and the Technique of its Application in Telecommunications," by W. H. Grinsted.

Measurements Section: 20th January: "Small Power Transformers for Aircraft Electrical Equipments," by A. Langley Morris. (Joint meeting with the Radio and Utilization Sections.) 25th January: Discussion on "Improved Methods of Meter Testing," opened by H. S. Petch. 8th February: "The Measurement of Light and Colour," by G. T. Winch. (Joint meeting with the Utilization Section). 22nd February: Discussion on "Automatic Precision Instruments," opened by Dr. A. T. Starr. 8th March: "The Development of Q-meter Methods of Impedance Measurement," by Dr. A. J. Biggs and Dr. J. E. Houldin. (Joint meeting with Radio Section.) 22nd March: Discussion on "Magnetic Amplifiers," opened by F. H. Belsey. 5th April: "Parasitic Forces existing in Induction Watthour Meters," by G. F. Shotter. 26th April: Discussion on "Apparatus for Limitation of Maximum Demand," opened by A. H. Gray. 3rd May: "Some Electromagnetic Problems," by Prof. G. W. O. Howe.

Radio Section: 20th January: Paper by A. Langley Morris (see above). 26th January: "The Development of Magnetic-Tape Recorders," by E. M. Payne. (Joint meeting with Acoustics Group of the Physical Society.) 2nd February: "Direction-Finding Site Errors at Very High Frequencies," by Dr. H. G. Hopkins and F. Horner, and "Scattering of Radio Waves by Metal Wires and Sheets," by F. Horner. 15th February: Discussion on "Water-Cooling versus Air-Cooling for High-Power Valves," opened by J. Bell. 2nd March: "The Analogies between the Vibrations of Elastic Membranes and the Electromagnetic Fields in Guides and Cavities," by E. C. Cherry. 8th March: Paper by Dr. A. J. Biggs and Dr. J. E. Houldin (see above). 15th March: Discussion on "The Planning of 'Business-Radio' Services at Very High Frequencies," opened by D. H. Hughes. 6th April: "Hot-Cathode Thyratrons: Practical Studies of Characteristics," by H. de B. Knight. 12th April: Informal lecture on "Radio-Frequency Heating," by Dr. R. H. Barfield. 4th May: Particulars to be announced. A social function will also be held in May on a date to be announced.

Supply Section: 9th February: "Selection of Transformers for Use in Distribution Networks, with special reference to the New Low-Voltage Standard of 240 Volts," by E. Tobin. 9th March: "Some Notes on the Design of High-Voltage Transmission Lines, with special reference to Conditions in India and Pakistan," by A. F. Coventry. 13th April: "The Detection of Winding Failures during Impulse Tests on Transformers by Oscillographic Methods," by E. C. Rippon and G. H. Hickling. 11th May: Annual Lecture (particulars to be announced). The dinner-dance will be held on 30th March at the Café Royal, W.1.

Utilization Section: 20th January: Paper by A. Langley Morris (see above). 8th February: "The Measurement of Light and Colour," by G. T. Winch. (Joint meeting with Measurements Section.) 10th February: "The Testing, Reconditioning and Servicing of Domestic Appliances," by H. Hobbins. 10th March: "The Automatic Control of Lead-Acid Battery Charging Equipment," by R. A. Hervey. 7th April: Short papers by younger members. 5th May: Lecture on "Some Aspects of Agricultural and Horticultural Electrification in the United States," by F. E. Rowland. The Section dinner will be held at the Café Royal on 8th April.

Education Discussion Circle: 7th February: Discussion on "Electrical Engineering taught to other than Electrical Engineers," opened by Prof. A. A. Hall and H. C. Mann. (Joint meeting with other Institutions.) 11th March: Discussion on "The Application of Flux Meters to Experiments on Electric Machines," opened by Prof. E. B. Moullin. 11th April: Discussion on "The Scheme for the Interchange of Information on Electrical Engineering Laboratory Practice," opened by Dr. E. Bradshaw, and "Transient Display Apparatus," opened by A. C. Normington. 9th May: Discussion on "Graphical Methods in Teaching Electrical Engineering (including Radio)," opened by S. N. Ray.

Informal meetings: 24th January: Discussion on "Generation of Electricity by Gas Turbine Plant," opened by L. J. Cheshire. 21st February: Discussion on "Industrial Design in Engineering," opened by N. E. Kearley. 21st March: Discussion on "Centralized Control and Indication in Power Stations," opener to be announced. 25th April: Discussion on "The Field for Battery Vehicles," opened by J. H. Johnson.

Next Week's Events

Monday, 17th January

BIRMINGHAM.—Grand Hotel, 6.15 p.m. Birmingham Electric Club. "Some Applications of Open-Cycle Gas Turbines," by F. E. Baumann.

BRISTOL.—Grand Hotel, 5 p.m. I.E.E. Western Supply Group. "Load Despatching and the Reasons for it, with special reference to the British Grid System," by A. R. Cooper.

CARDIFF.—At the South Wales Institute, Park Place, 6.30 p.m. I.E.E. Cardiff Students' Section. "Some Features of Design and Construction of Electric Overhead Travelling Cranes," by A. C. M. Figsworth.

LIVERPOOL.—Royal Institution, Colquitt Street, 6.30 p.m. Joint meeting of the I.E.E. Mersey and North Wales Centre and the Liverpool Engineering Society. "Waterworks Power Plant Practice: the Comparative Costs of Steam, Diesel and Electrically Operated Plant," by T. P. Wakeford.

Tuesday, 18th January

LONDON.—Savoy Place, W.C.2. 5.30 p.m. I.E.E. Radio Section. Discussion on "Should British Universities consider the Establishment of Special Degrees in Radio?" opened by Prof. E. B. Moullin.

Lighting Service Bureau, 2, Savoy Hill, W.C.2, 6.15 p.m. Association of Supervising Electrical Engineers. "The Quality of Illumination," by Dr. J. W. T. Walsh.

Wednesday, 19th January

BOURNEMOUTH.—Wedgwood Café, Albert Road, 6.30 p.m. I.E.E. Southern Centre. "Survey of Metering Practice on the British Grid System," by F. Byrne.

BRISTOL.—Victoria Rooms, 6.30 p.m. I.E.E. Western Centre. Faraday Lecture on "Television," by Sir Noel Ashbridge.

LIVERPOOL.—24, Dale Street, 6 p.m. Joint meeting of the I.E.E. Mersey and North Wales Centre and the Liverpool Engineering Society. "Communication of Technical Ideas," by H. E. Dance.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply Section. "Substations, with particular reference to Yorkshire Practice," by L. H. Fuller and C. R. Clarke.

I.E.E. London Students' Section, 2 p.m. Visit to Kodak, Ltd., Wealdstone, Harrow.

L.T.R. Headquarters Refreshment Club, 8th Floor, Waterloo Bridge House, S.E.1, 5 p.m. Institution of Post Office Electrical Engineers. Informal meeting. "Current Telephone Switching Practice in the U.S.A.," by J. A. Lawrence.

At the Royal Institution, Albemarle Street, W.1, 6.30 p.m. Joint meeting of the London Sections of the Plastics Groups of the Society of Chemical Industry. "Synthetic Fibres—Historical Survey of the Development of some Synthetic Fibrous Materials," by H. V. Potter.

MANCHESTER.—Engineers' Club, Albert Square, 6.30 p.m. I.E.E. North-Western Radio Group. "Three-Dimensional Cathode-Ray-Tube Displays," by E. Parker and P. R. Wallis.

Engineers' Club, Albert Square, 7 p.m. A.S.E.E. Manchester Branch. "Radar," by a speaker from the Metropolitan-Vickers Co.

PRESTON.—Harris Institute, 6.45 p.m. I.E.E. North-Western Centre. "The Lightning Protection of High-Voltage Transmission and Distribution Systems," by H. M. Lacey.

SHEFFIELD.—Royal Victoria Station Hotel, 6.15 p.m. I.E.E. Sheffield Sub-Centre. "Centralized Ripple Control on High-Voltage Networks," by T. W. Ross and R. M. A. Smith.

Thursday, 20th January

DUBLIN.—Trinity College, 6 p.m. I.E.E. Irish Branch. "Some Projects favourable to Direct-Current Transmission and the Role of the British Electrical Industry in Relation thereto," by F. J. Errol and Lord Forrester.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Utilization Section. "Small Power Transformers for Aircraft Electrical Equipment," by A. Langley Morris. (Joint meeting with the Radio and Measurements Sections.)

Waldorf Hotel, W.C.2, 6.45 p.m. Institution of Works Managers. "Modern Lighting in a Factory," by J. Aldington.

NEWCASTLE-ON-TYNE.—Royal Station Hotel, Neville Street, 4 p.m. E.I.B.A. Northern Counties Area. Annual general meeting.

WORCESTER.—Worcester Electric Club. Annual dinner.

Friday, 21st January

BIRMINGHAM.—Imperial Hotel, Temple Street, 6 p.m. Illuminating Engineering Society (Birmingham Centre). Symposium of papers.

NEWCASTLE-ON-TYNE.—King's College, 7 p.m. I.E.E. North-Eastern Students' Section. "Magnetic Measurements," by B. E. Western.

STOKE-ON-TRENT.—Midland Electricity Board Lecture Hall, 7 p.m. I.E.E. North Staffordshire Sub-Centre. Discussion on "Staff Management: A Problem for the Electrical Engineer," opened by D. Smith.

Saturday, 22nd January

LEEDS.—Association of Mining Electrical and Mechanical Engineers (Yorkshire North-West Branch). Pantomime and dinner.

MANCHESTER.—St. Mary's Parsonage, 2.30 p.m. Junior Institution of Engineers (North-Western Section). "The Engineering Approach to Photography," by L. H. A. Carr.

Electric Vehicle Lecture

AT a recent sales conference held at Leeds under the auspices of the Yorkshire Area Committee of E.D.A., Mr. R. C. Hawkins, assistant secretary of the Electric Vehicle Association, read a paper on "Electric Vehicles," in which he showed the important part played by the battery electric vehicle in modern transport. Among the many aspects of the subject dealt with by Mr. Hawkins were pedestrian operated and passenger electric vehicles; costs, limitations and capabilities; progress made in electric vehicle development; and the future prospects of the market for "electrics."

CONTRACT INFORMATION

ACCEPTED TENDERS AND PROSPECTIVE ELECTRICAL WORK

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—BRISBANE.—17th February. City Electric Light Co., Ltd. 11-kV, 6.6-kV, 3.3-kV and 660-V cables. (E.P.D. 55394/48. Ten/101.)*

Belfast.—4th February. Electricity Department. Electrical materials. (See this issue.)

Belgium.—BRUSSELS.—16th February. Belgian State Railways. Supply of eighty automatic telephone selectors. (E.P.D. 55494/48. Ten/123.)*

Bournemouth.—4th February. Borough Council. Electric lamps, cables and electrical accessories for one year to 31st March, 1950. W. L. Clowes, borough engineer, Room 45, Town Hall.

Erpingham.—5th February. R.D.C. Removal of existing pumping and filtration plants and provision and installation of electrically driven submersible-type pumping plant; and provision and installation of pressure-type filtration plant for Mundesley Waterworks extension scheme. J. C. Mellis and Co., engineers, 110, Horseferry Road, Westminster, London, S.W.1.

Hayes and Harlington.—2nd February. U.D.C. Supply of gas-filled general lighting service lamps and automatic lamps; medium- and low-voltage cables; vehicle accumulator batteries; and electric discharge lamps for street lighting, all for one year to 31st March, 1950. Particulars from A. E. Higgins, clerk of the Council, Town Hall, Hayes, Middx.

Kent.—Firms wishing to be included in the County Council's lists of contractors for electrical engineering works are invited to submit applications. (See this issue.)

Newcastle-on-Tyne.—Installation of electric lighting in 158 houses on the Montagu estate. City architect, 18, Cloth Market.

New Zealand.—WELLINGTON.—26th April. Ministry of Works. Supply of 100-ton electric travelling gantry crane. (E.P.D. 55396/48. Ten/102.)*

Pakistan.—KARACHI.—The date for the receipt of tenders for four 500-kW hydro-electric generating units for the Dargai power station has been extended to 3rd February. (E.P.D. 41985/48. Ten/35A.)*

Peterborough.—24th January. Area Hospital Management Committee. Electrical installation work at the North Cambridgeshire Hospital, Wisbech. C. Masterman, secretary to the Committee, 54, Park Road.

South Africa. — PORT ELIZABETH. — 3rd February. Electricity Department. Transformers and steel poles. (E.P.D. 55117/48. Ten/104.)*

DURBAN.—18th March. City Council. Street lighting fittings. (E.P.D. 55308/48. Ten/105.)*

Southern Rhodesia.—SALISBURY.—8th March. Electricity Supply Commission. Switchgear. (E.P.D. 55292/48. Ten/115.)*

Sutton and Cheam.—21st January. Town Council. Electrical installations in 18 flats, Hurstcourt Road North. N. H. Michell, borough engineer, Municipal Offices, High Street.

Swansea.—5th February. Borough Council. Electric lamps for public lighting for one year from 1st April, 1949. Borough surveyor, Guildhall.

Tottenham.—4th February. Borough Council. Supply of electric lamps for one year. M. Lindsay Taylor, town clerk, Town Hall, N.15.

Orders Placed

Manchester.—Corporation. Accepted. Electrical installations in forty flats at Miles Platting (Contract No. 2).—A. E. Sudlow & Co.

Northumberland. — Education Committee. Accepted. Supply of electrical equipment for practical instruction huts at a number of schools at a total cost of £3,810.—North-Eastern Electricity Board.

South Shields.—Town Council. Accepted. Installation of fluorescent lighting at the junction of King Street and Fowler Street (£237).—G.E.C.

Education Committee. Accepted. Electrical installation at the new Horsley Hill County Junior Boys' and Girls' School (£2,860).—Law & Burns.

Surrey.—County Council. Accepted. Electrical installation at Kingston Vale Primary School.—Alpha Manufacturing & Electrical Co.

Tipton.—Corporation. Accepted. Supply and installation of fifty-six electric lighting points in connection with a modified scheme for the provision of street lighting on certain roads on the Upper Church Lane estate (£1,598).—Midlands Electricity Board.

West Hartlepool.—Education Committee. Accepted. Electrical installation in connection with additions to the Art School.—Heslop & Hall.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Bolton.—Maintenance block for new works, Union Road, including generator house, etc.; H. Platt, manager, Gas Offices, Hotel Street.

Bromsgrove.—Houses (70) for U.D.C.; S. J. Smith & Co., builders, 70, Newhall Street.

Chailey (Sussex).—Nurses' home for Heritage Craft Schools; Searle & Searle, architects, Warwick Square, London, E.C.4.

Chester-le-Street.—Houses (120); U.D.C. surveyor, Council Chambers.

Edinburgh.—Extensions to Dental Hospital (£130,000); Scottish Regional Hospital Board, 11, Drumsheugh Gardens.

Houses (111), Saughton Mains area, for Corporation; city architect, City Chambers.

*** Specifications may be inspected at the Commercial Relations and Exports Department, Thames House North, Millbank, S.W.1.**

Flintshire.—Junior and infants' mixed school, Mostyn; W. Griffiths, deputy county architect, Mold.

Grantham. — Nurses' hostel adjoining Grantham Hospital; Regional Hospital Board, Sheffield.

Harrogate.—Treatment and research centre (£500,000); Regional Hospital Board, Leeds.

Hastings.—Bakery, Mount Pleasant Road; C.W.S. Retail Co-operative Society, Ltd., 99, Leman Street, E.1.

Hemel Hempstead.—Houses (22), Beechfield estate; Louis de Soissons, architect, Midland Bank Chambers, Welwyn Garden City.

Jarrow.—Dairy for the Jarrow and Hebburn Co-op. Society, Albert Road, Jarrow (£70,000); C.W.S. Architects' Dept., 90, Westmorland Road, Newcastle-on-Tyne.

Factory on the Bede estate for North-Eastern Trading Estates, Ltd. (£19,872); David Glen, builder, 84, Albert Road, Jarrow-on-Tyne.

Kingston-on-Thames.—Block of flats, Grange site, Kingston Hill; Sydney Clough, Son & Partners, architects, 115, Park Street, W.1.

Lancashire.—Technical school, Todmorden; county architect, Preston.

Loftus.—Houses (30); U.D.C. surveyor.

London.—PLUMSTEAD.—Ward block at St. Nicholas Hospital (£45,000); South-Eastern Metropolitan Hospitals Board, Portland Place, W.1.

WANDSWORTH.—Dwellings (232), Notre Dame, Clapham (£537,564); W. Moss & Sons, builders, Cricklewood, N.W.2.

LEWISHAM.—Rebuilding King's Hall Cinema, Lewisham High Street; Members' Cinemas (1943), Ltd., 32, Shaftesbury Avenue, W.1.

WESTMINSTER.—Three blocks of dwellings, Pulford Terrace; Westminster Housing Trust, Ltd., 41, Whitehall, S.W.1.

MERTON ABBEY.—Laboratory and workshops; James Ferguson & Sons, Ltd., Prince George's Road, S.W.19.

Lowestoft.—Infants' school, between Ethel Road and Love Road (£70,000); borough engineer.

Mansfield.—Offices and works for G. E. Neville & Son, Ltd.; Fletcher & Chance, architects, Portland Square, Sutton-in-Ashfield, Notts.

Middlesbrough. — Houses (48), Thorntree estate; Hudson Brothers, builders.

Aluminium school, Denmark Street; Bristol Aeroplane Co. (Housing), Ltd., contractors.

Newcastle-on-Tyne.—Additions to the Rutherford College of Technology; city education department, 31, Northumberland Road.

Newport (Mon).—Malpas School (£130,000) for E.C.; J. Blackett, borough architect.

Northallerton.—Extensions to the Oak Bank Tannery; Card Clothing and Belting, Ltd., West Grove Mill, Halifax, Yorks.

Scarborough.—Factory, Mount View Avenue, for Coastal Food Recovery, Ltd.

Seaham.—Factory for disabled persons; Disabled Persons' Employment Corporation, London.

Shrewsbury.—Extensions, County Domestic Science Training College, for Education Committee; Willink & Dod, architects, Cunard Building, Liverpool, 3.

Shilbottle.—Workshops and offices, Whittle Colliery; North Divisional Coal Board, Collingwood Buildings, Newcastle-on-Tyne.

South Shields.—Warehouse and offices; Progressive Wholesale Co., Ltd., 225, South Eldon Street.

Mineral water factory for G. E. Evans & Co.; Howard Hill, architect, Winchester Street, South Shields.

Stourbridge.—Reconstruction of Town Hall; Webb & Gray, architects, 200, High Street, Dudley.

Surbiton.—Houses (40), Fullers Way; Bunting Construction Co., Ltd., builders, 73, Acre Lane, S.W.2.

Houses (60), Buckland Road, Chessington; Walter Stokes (Westlands), Ltd., builders, Roebeck Road.

Treharris.—Extensions and alterations to school and administrative buildings, and erection of staff houses on land adjoining South Wales and Monmouthshire Approved School; T. Edmund Rees, architect, Merthyr Tydfil.

Tynemouth.—Fire station (£58,000); borough engineer, 19, Howard Street, North Shields.

West Hartlepool.—Works modernization for the South Durham Steel & Iron Co., Ltd. (£1,500,000).

Weston-super-Mare.—Flats (40), Bournville estate; borough surveyor.

Wigton.—Farm workers' houses at 14 villages; R.D.C. surveyor, Council Offices, Wigton.

Trade Marks

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered within one month from 5th January:—

MAGNETA. No. B647,512, Class 9. Sound and amplifying apparatus, loud speakers, radio-gramophones, microphones, thermionic amplifiers, and thermionic electric apparatus for generating signals.—British Vacuum Cleaner & Engineering Co., Ltd., and the Magneta Time Co., Ltd., both of Goblin Works, Ermyn Way, Leatherhead, Surrey, and 3, Great Winchester Street, London, E.C.2.

FALKS. No. B655,475, Class 9. Electric cables, electric ceiling roses, conduits, cut-outs, distribution fuse boards, junction boxes, switchboards, switches, socket and plug connections. No. B655,476, Class 11. Cooking apparatus, heating stoves and heat radiators, all operated by electricity, gas or oil; and illuminating oil lamps, oil lanterns and electric lighting fittings.—Falk Stadelmann & Co., Ltd., Veritas House, 91, Farringdon Road, London, E.C.1.

LEWCOL. No. 662,466, Class 9. Electric flat-irons.—N. H. Lucas, E. Lucas and H. T. Holder, trading as Lucas Holder & Co., 25, Allesley Old Road, Coventry.

EMITAPE. No. 664,488, Class 9. Sound records and sound recording media all in the form of tape.—Electric & Musical Industries, Ltd., Blyth Road, Hayes, Middx.

MEOPTA. No. 665,506, Class 9. Electrical apparatus included in Class 9; scientific, surveying, wireless, photographic, cinematographic, optical, measuring and signalling apparatus; apparatus for recording and reproducing sound; and parts of and fittings for all such goods, all included in Class 9.—Meopta, Prerov, Czechoslovakia. Address for service. c/o Reddie & Grose, 6, Breams Buildings, E.C.4.

SARGROVE. No. B667,098, Class 9. Wireless, television, telegraphic and telephonic instruments and apparatus and parts included in Class 9 of all such goods.—J. A. Sargrove, Dockett-Eddy House, Shepperton-on-Thames.

ELEGATER. No. 664,525, Class 12. Electrically-propelled road vehicles, sold complete. HELECS,, No. 664,528, and STALLION, No. 664,766. Class 12. Electrically-propelled road vehicles, and parts thereof not included in other classes.—Hindle, Smart & Co., Ltd., 20, Wilmslow Road, Withington, Manchester.

DATLEC. No. 668,202, Class 14. Electric clocks.—S. Stein, trading as Speedwell Services, Watchett Works, Oakhurst Road, Southend-on-Sea.